FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 3

SAN MATEO COUNTY, CALIFORNIA

AND INCORPORATED AREAS

COMMUNITY NAME	NUMBER	COMMUNITY NAME	NUMBER
ATHERTON, TOWN OF*	060312	SOUTH SAN FRANCISCO, CITY OF	065062
BELMONT, CITY OF	065016	WOODSIDE, TOWN OF	060330
BRISBANE, CITY OF	060314		
BURLINGAME, CITY OF	065019		
COLMA, TOWN OF	060316		
DALY CITY, CITY OF	060317		
EAST PALO ALTO, CITY OF	060708		
FOSTER CITY, CITY OF	060318		
HALF MOON BAY, CITY OF	060319		
HILLSBOROUGH, TOWN OF	060320		
MENLO PARK, CITY OF	060321		
MILLBRAE, CITY OF	065045		
PACIFICA, CITY OF	060323		
PORTOLA VALLEY, TOWN OF	065052		
REDWOOD CITY, CITY OF	060325		
SAN BRUNO, CITY OF *	060326		
SAN CARLOS, CITY OF	060327		
SAN MATEO COUNTY (UNINCORPORATED AREAS)	060311		
SAN MATEO, CITY OF	060328		

*No Special Flood Hazard Areas Identified

PRELIMINARY

SEP 14, 2015

REVISED:

FEMA

FLOOD INSURANCE STUDY NUMBER
06081CV001C

Version Number 2.3.2.1

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Published Separately

FLOOD INSURANCE STUDY REPORT
SAN MATEO COUNTY, CALIFORNIA

SECTION 1.0 – INTRODUCTION

1.1 The National Flood Insurance Program

The National Flood Insurance Program (NFIP) is a voluntary Federal program that enables property owners in participating communities to purchase insurance protection against losses from flooding. This insurance is designed to provide an alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods.

For decades, the national response to flood disasters was generally limited to constructing flood-control works such as dams, levees, sea-walls, and the like, and providing disaster relief to flood victims. This approach did not reduce losses nor did it discourage unwise development. In some instances, it may have actually encouraged additional development. To compound the problem, the public generally could not buy flood coverage from insurance companies, and building techniques to reduce flood damage were often overlooked.

In the face of mounting flood losses and escalating costs of disaster relief to the general taxpayers, the U.S. Congress created the NFIP. The intent was to reduce future flood damage through community floodplain management ordinances, and provide protection for property owners against potential losses through an insurance mechanism that requires a premium to be paid for the protection.

The U.S. Congress established the NFIP on August 1, 1968, with the passage of the National Flood Insurance Act of 1968. The NFIP was broadened and modified with the passage of the Flood Disaster Protection Act of 1973 and other legislative measures. It was further modified by the National Flood Insurance Reform Act of 1994 and the Flood Insurance Reform Act of 2004. The NFIP is administered by the Federal Emergency Management Agency (FEMA), which is a component of the Department of Homeland Security (DHS).

Participation in the NFIP is based on an agreement between local communities and the Federal Government. If a community adopts and enforces floodplain management regulations to reduce future flood risks to new construction and substantially improved structures in Special Flood Hazard Areas (SFHAs), the Federal Government will make flood insurance available within the community as a financial protection against flood losses. The community's floodplain management regulations must meet or exceed criteria established in accordance with Title 44 Code of Federal Regulations (CFR) Part 60.3, *Criteria for land Management and Use*.

SFHAs are delineated on the community's Flood Insurance Rate Maps (FIRMs). Under the NFIP, buildings that were built before the flood hazard was identified on the community's FIRMs are generally referred to as "Pre-FIRM" buildings. When the NFIP was created, the U.S. Congress recognized that insurance for Pre-FIRM buildings would be prohibitively expensive if the premiums were not subsidized by the Federal Government. Congress also recognized that most of these floodprone buildings were built by individuals who did not have sufficient knowledge of the flood hazard to make informed decisions. The NFIP requires that full actuarial rates reflecting the complete flood risk be charged on all buildings constructed or substantially improved on or after the effective date of the initial FIRM for the community or after December 31, 1974, whichever is later. These buildings are generally referred to as “Post-FIRM” buildings.

1.2 Purpose of this Flood Insurance Study Report

This Flood Insurance Study (FIS) Report revises and updates information on the existence and severity of flood hazards for the study area. The studies described in this report developed flood hazard data that will be used to establish actuarial flood insurance rates and to assist communities in efforts to implement sound floodplain management.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive than the minimum Federal requirements. Contact your State NFIP Coordinator to ensure that any higher State standards are included in the community’s regulations.

1.3 Jurisdictions Included in the Flood Insurance Study Project

This FIS Report covers the entire geographic area of San Mateo County, California.

The jurisdictions that are included in this project area, along with the Community Identification Number (CID) for each community and the 8-digit Hydrologic Unit Codes (HUC-8) sub-basins affecting each, are shown in Table 1. The Flood Insurance Rate Map (FIRM) panel numbers that affect each community are listed. If the flood hazard data for the community is not included in this FIS Report, the location of that data is identified.

The location of flood hazard data for participating communities in multiple jurisdictions is also indicated in the table.

Jurisdictions that have no identified SFHAs as of the effective date of this study are indicated in the table. Changed conditions in these communities (such as urbanization or annexation) or the availability of new scientific or technical data about flood hazards could make it necessary to determine SFHAs in these jurisdictions in the future.

Table 1: Listing of NFIP Jurisdictions

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Atherton, Town of[1]	060312	18050004	06081C0302E 06081C0303E 06081C0304E[2] 06081C0306E 06081C0308E 06081C0311E 06081C0312E[2]	
Belmont, City of	065016	18050004	06081C0165E[2] 06081C0167F 06081C0168F 06081C0169F 06081C0285E	

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Brisbane, City of	060314	18050004	06081C0035E 06081C0041E 06081C0042E 06081C0055E[2] 06081C0060E[2] 06081C0061E 06081C0065E[2] 06081C0070E[2]	
Burlingame, City of	065019	18050004	06081C0132E 06081C0134E 06081C0151E 06081C0152E[2] 06081C0153E 06081C0154F	
Colma, Town of	060316	18050004	06081C0029G[2] 06081C0036F 06081C0037E 06081C0041E	
Daly City, City of	060317	18050004 18050006	06081C0028G 06081C0029G 06081C0035E 06081C0036F 06081C0037E 06081C0038F 06081C0039E[2]	
East Palo Alto, City of	060708	18050004	06081C0307E 06081C0309E 06081C0326E 06081C0328E	
Foster City, City of	060318	18050004	06081C0158F 06081C0159F 06081C0160E[2] 06081C0166F 06081C0167F 06081C0178E 06081C0180E[2] 06081C0185E[2] 06081C0186E 06081C0195E	

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Half Moon Bay, City of	060319	18050006	06081C0138F 06081C0140E 06081C0251F 06081C0252G 06081C0254G 06081C0260E 06081C0262G 06081C0266G	
Hillsborough, Town of	060320	18050004	06081C0134E 06081C0145E[2] 06081C0153E 06081C0154F 06081C0162F 06081C0165E[2]	
Menlo Park, City of	060321	18050004	06081C0195E 06081C0215E 06081C0302E 06081C0304E[2] 06081C0306E 06081C0307E 06081C0308E 06081C0309E 06081C0311E 06081C0312E[2] 06081C0320E[2] 06081C0326E 06081C0328E 06081C0330E[2]	
Millbrae, City of	065045	18050004	06081C0131E 06081C0132E 06081C0133E 06081C0134E 06081C0151E	
Pacifica, City of	060323	18050006	06081C0036F 06081C0038F 06081C0039E[2] 06081C0107F 06081C0109F 06081C0126F	

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Pacifica, City of	060323	18050006	06081C0127E 06081C0128E 06081C0129E	
Portola Valley, Town of	065052	18050003	06081C0294E 06081C0313E 06081C0314E 06081C0385E[2] 06081C0401E 06081C0402E 06081C0405E[2]	
Redwood City, City of	060325	18050004	06081C0167F 06081C0169F 06081C0178E 06081C0180E[2] 06081C0185E[2] 06081C0186E 06081C0187E 06081C0188E 06081C0189E 06081C0195E 06081C0282E 06081C0285E 06081C0301E 06081C0302E 06081C0303E 06081C0304E[2] 06081C0306E	
San Bruno, City of[1]	060326	18050004 18050006	06081C0038F 06081C0039E[2] 06081C0043E 06081C0044E 06081C0127E 06081C0131E 06081C0132E	
San Carlos, City of	060327	18050004	06081C0168E 06081C0169E 06081C0188E 06081C0282E 06081C0285E 06081C0301E	

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
San Mateo County, Unincorporated Areas	060311	18050003 18050004 18050006 18060015	06081C0009G 06081C0028G 06081C0029G 06081C0035E 06081C0036F 06081C0037E 06081C0038F 06081C0039E[2] 06081C0041E 06081C0042E 06081C0043E 06081C0044E 06081C0063E 06081C0065E[2] 06081C0070E[2] 06081C0090E[2] 06081C0107F 06081C0109F 06081C0117F 06081C0119F 06081C0127E 06081C0128E 06081C0129E 06081C0131E 06081C0132E 06081C0133E 06081C0134E 06081C0136E 06081C0138F 06081C0140E 06081C0145E[2] 06081C0151E 06081C0152E[2] 06081C0160E[2] 06081C0162F 06081C0165E[2] 06081C0168F 06081C0169F 06081C0180E[2] 06081C0232F 06081C0251F	

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
San Mateo County, Unincorporated Areas	060311	18050003 18050004 18050006 18060015	06081C0252G 06081C0254G 06081C0260E 06081C0262G 06081C0266G 06081C0267G 06081C0268G 06081C0269G 06081C0280E[2] 06081C0282E 06081C0285E 06081C0290E[2] 06081C0292E 06081C0294E 06081C0295E[2] 06081C0301E 06081C0302E 06081C0303E 06081C0304E[2] 06081C0306E 06081C0308E 06081C0311E 06081C0312E[2] 06081C0313E 06081C0314E 06081C0320E[2] 06081C0356G 06081C0357G 06081C0359G 06081C0366G 06081C0367G 06081C0368F 06081C0369E 06081C0380E 06081C0383E 06081C0384E 06081C0385E[2] 06081C0388E 06081C0390E 06081C0391E 06081C0392E	

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
San Mateo County, Unincorporated Areas	060311	18050003 18050004 18050006 18060015	06081C0395E 06081C0401E 06081C0402E 06081C0405E[2] 06081C0410E[2] 06081C0415E[2] 06081C0420E[2] 06081C0431G 06081C0432E 06081C0433G 06081C0434G 06081C0442G 06081C0451E 06081C0455E 06081C0460E[2] 06081C0461G 06081C0462G 06081C0463G 06081C0464G 06081C0470E 06081C0500E[2] 06081C0502G 06081C0506G	
San Mateo, City of	060328	18050004	06081C0152E[2] 06081C0153E 06081C0154F 06081C0158F 06081C0159F 06081C0160E[2] 06081C0162F 06081C0165E[2] 06081C0166F 06081C0167F 06081C0168F 06081C0169F	

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
South San Francisco, City of	065062	18050004	06081C0037E 06081C0038F 06081C0039E[2] 06081C0041E 06081C0042E 06081C0043E 06081C0044E 06081C0061E 06081C0063E 06081C0065E[2] 06081C0070E[2] 06081C0090E[2]	
Woodside, Town of	060330	18050003 18050004 18050006	06081C0285E 06081C0292E 06081C0294E 06081C0295E[2] 06081C0303E 06081C0311E 06081C0313E 06081C0385E[2]	

[1] No Special Flood Hazard Areas Identified

[2] Panel Not Printed

1.4 Considerations for using this Flood Insurance Study Report

The NFIP encourages State and local governments to implement sound floodplain management programs. To assist in this endeavor, each FIS Report provides floodplain data, which may include a combination of the following: 10-, 4-, 2-, 1-, and 0.2-percent annual chance flood elevations (the 1% annual chance flood elevation is also referred to as the Base Flood Elevation (BFE)); delineations of the 1% annual chance and 0.2% annual chance floodplains; and 1% annual chance floodway. This information is presented on the FIRM and/or in many components of the FIS Report, including Flood Profiles, Floodway Data tables, Summary of Non-Coastal Stillwater Elevations tables, and Coastal Transect Parameters tables (not all components may be provided for a specific FIS).

This section presents important considerations for using the information contained in this FIS Report and the FIRM, including changes in format and content. Figures 1, 2, and 3 present information that applies to using the FIRM with the FIS Report.

- Part or all of this FIS Report may be revised and republished at any time. In addition, part of this FIS Report may be revised by a Letter of Map Revision (LOMR), which does not involve republication or redistribution of the FIS Report. Refer to Section 6.5 of this FIS Report for information about the process to revise the FIS Report and/or FIRM.

It is, therefore, the responsibility of the user to consult with community officials by contacting the community repository to obtain the most current FIS Report components. Communities participating in the NFIP have established repositories of flood hazard data for floodplain management and flood insurance purposes. Community map repository addresses are provided in Table 31, "Map Repositories," within this FIS Report.

- New FIS Reports are frequently developed for multiple communities, such as entire counties. A countywide FIS Report incorporates previous FIS Reports for individual communities and the unincorporated area of the county (if not jurisdictional) into a single document and supersedes those documents for the purposes of the NFIP.

  The initial Countywide FIS Report for San Mateo County became effective on October 16, 2012. Refer to Table 28 for information about subsequent revisions to the FIRMs.

- FEMA does not impose floodplain management requirements or special insurance ratings based on Limit of Moderate Wave Action (LiMWA) delineations at this time. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. If the LiMWA is shown on the FIRM, it is being provided by FEMA as information only. For communities that do adopt Zone VE building standards in the area defined by the LiMWA, additional Community Rating System (CRS) credits are available. Refer to Section 2.5.4 for additional information about the LiMWA.

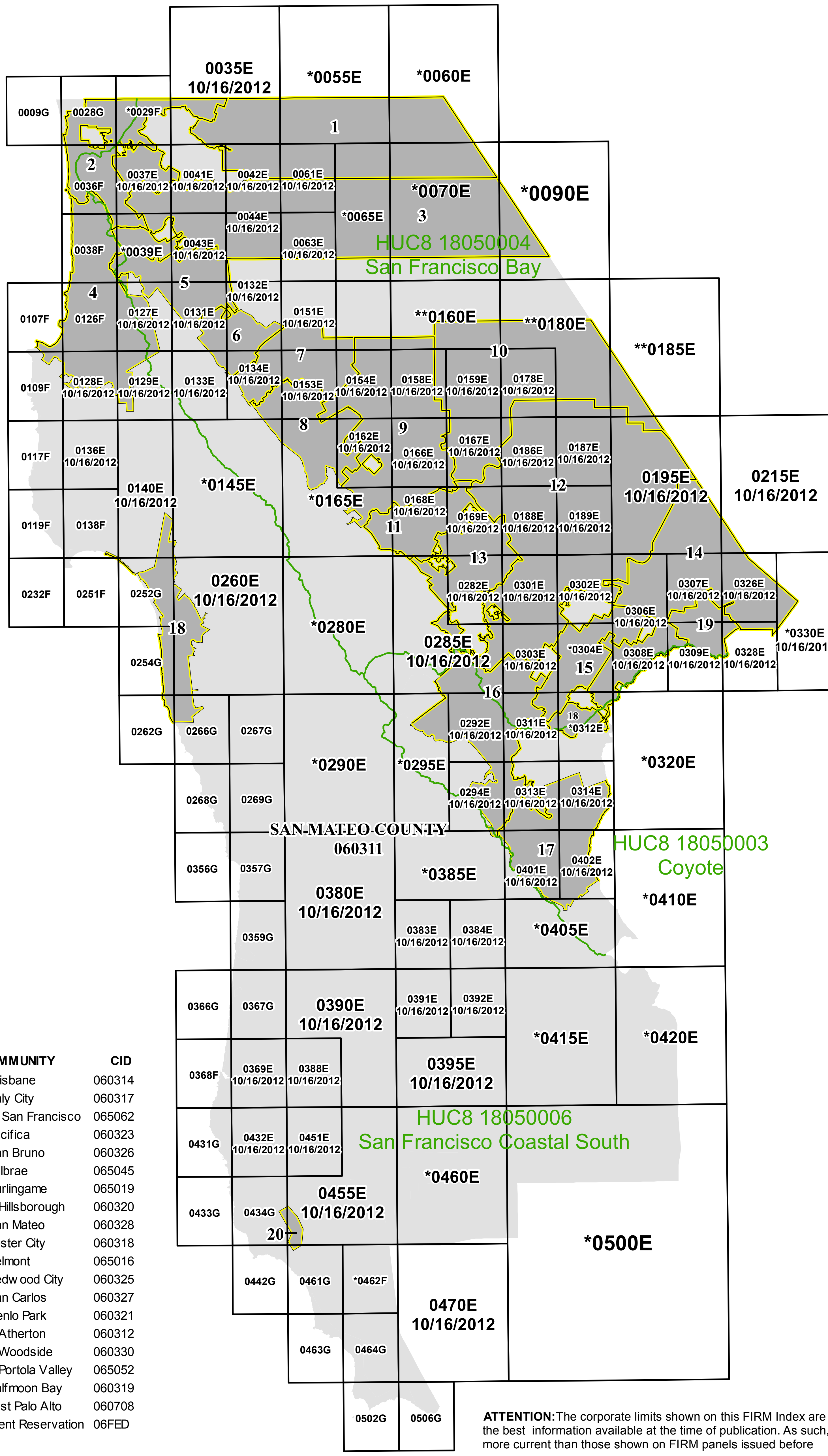
  The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. Visit the FEMA Web site at www.fema.gov/national-flood-insurance-program-community-rating-system or contact your appropriate FEMA Regional Office for more information about this program.

- Previous FIS Reports and FIRMs may have included levees that were accredited as reducing the risk associated with the 1% annual chance flood based on the information available and the mapping standards of the NFIP at that time. For FEMA to continue to accredit the identified levees, the levees must meet the criteria of the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10), titled "Mapping of Areas Protected by Levee Systems."

  Since the status of levees is subject to change at any time, the user should contact the appropriate agency for the latest information regarding levees presented in Table 9 of this FIS Report. For levees owned or operated by the U.S. Army Corps of Engineers (USACE), information may be obtained from the USACE national levee database (nld.usace.army.mil). For all other levees, the user is encouraged to contact the appropriate local community.

- FEMA has developed a *Guide to Flood Maps* (FEMA 258) and online tutorials to assist users in accessing the information contained on the FIRM. These include how to read panels and step-by-step instructions to obtain specific information. To obtain this guide and other assistance in using the FIRM, visit the FEMA Web site at www.fema.gov/online-tutorials.

The FIRM Index in Figure 1 shows the overall FIRM panel layout within San Mateo County, and also displays the panel number and effective date for each FIRM panel in the county. Other information shown on the FIRM Index includes community boundaries, flooding sources, watershed boundaries, and United States Geological Survey (USGS) Hydrologic Unit Code – 8 (HUC-8) codes.



KEY NUMBER	COMMUNITY	CID
1	City of Brisbane	060314
2	City of Daly City	060317
3	City of S. San Francisco	065062
4	City of Pacifica	060323
5	City of San Bruno	060326
6	City of Millbrae	065045
7	City of Burlingame	065019
8	Town of Hillsborough	060320
9	City of San Mateo	060328
10	City of Foster City	060318
11	City of Belmont	065016
12	City of Redwood City	060325
13	City of San Carlos	060327
14	City of Menlo Park	060321
15	Town of Atherton	060312
16	Town of Woodside	060330
17	Town of Portola Valley	065052
18	City of Halfmoon Bay	060319
19	City of East Palo Alto	060708
20	Government Reservation	06FED

ATTENTION: The corporate limits shown on this FIRM Index are based on the best information available at the time of publication. As such, they may be more current than those shown on FIRM panels issued before

N

1 inch = 17,971 feet 1:215,657

0 5,000 10,000 20,000 30,000 40,000 feet

Map Projection:
Universal Transverse Mercator Zone 10 North;
North American Datum 1983

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTP://MSC.FEMA.GOV

SEE FLOOD INSURANCE STUDY FOR ADDITIONAL INFORMATION

* PANEL NOT PRINTED - NO SPECIAL FLOOD HAZARD AREAS
** PANEL NOT PRINTED - OPEN WATER

COUNTY LOCATOR

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP INDEX

SAN MATEO COUNTY, CALIFORNIA and Incorporated Areas

PANELS PRINTED:
0009, 0028, 0035, 0036 , 0037, 0038, 0041, 0042, 0043, 0044, 0061, 0063, 0107, 0109, 0117, 0119, 0126, 0127, 0128, 0129, 0131, 0132, 0133, 0134, 0136, 0138, 0140, 0151, 0153, 0154, 0158, 0159, 0162, 0166, 0167, 0168, 0169, 0178, 0186, 0187, 0188, 0189, 0195, 0215, 0232, 0251, 0252, 0254, 0260, 0262, 0266, 0267, 0268, 0269, 0282, 0285, 0292, 0294, 0301, 0302, 0303, 0306, 0307, 0308, 0309, 0311, 0313, 0314, 0326, 0328, 0356, 0357, 0359, 0366, 0367, 0368, 0369, 0380, 0383, 0384, 0388, 0390, 0391, 0392, 0395, 0401, 0402, 0431, 0432, 0433, 0434, 0442, 0451, 0455, 0461, 0463, 0464, 0470, 0502, 0506

U.S. DEPARTMENT OF HOMELAND SECURITY

FEMA

PRELIMINARY

MAP NUMBER
06081CIND1D

MAP REVISED

Each FIRM panel may contain specific notes to the user that provide additional information regarding the flood hazard data shown on that map. However, the FIRM panel does not contain enough space to show all the notes that may be relevant in helping to better understand the information on the panel. Figure 2 contains the full list of these notes.

Figure 2: FIRM Notes to Users

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products, or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Flood Map Service Center website or by calling the FEMA Map Information eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates, refer to Table 28 in this FIS Report.

To determine if flood insurance is available in the community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

PRELIMINARY FIS REPORT: FEMA maintains information about map features, such as street locations and names, in or near designated flood hazard areas. Requests to revise information in or near designated flood hazard areas may be provided to FEMA during the community review period, at the final Consultation Coordination Officer's meeting, or during the statutory 90-day appeal period. Approved requests for changes will be shown on the final printed FIRM.

The map is for use in administering the NFIP. It may not identify all areas subject to flooding, particularly from local drainage sources of small size. Consult the community map repository to find updated or additional flood hazard information.

BASE FLOOD ELEVATIONS: For more detailed information in areas where Base Flood Elevations (BFEs) and/or floodways have been determined, consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables within this FIS Report. Use the flood elevation data within the FIS Report in conjunction with the FIRM for construction and/or floodplain management.

Coastal Base Flood Elevations shown on the map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Coastal flood elevations are also provided in the Coastal Transect Parameters table in the FIS Report for this jurisdiction. Elevations shown in the Coastal Transect Parameters table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on the FIRM.

Figure 2. FIRM Notes to Users

FLOODWAY INFORMATION: Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the FIS Report for this jurisdiction.

FLOOD CONTROL STRUCTURE INFORMATION: Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to Section 4.3 "Non-Levee Flood Protection Measures" of this FIS Report for information on flood control structures for this jurisdiction.

PROJECTION INFORMATION: The projection used in the preparation of the map was Universal Transverse Mercator (UTM) Zone 10**.** The horizontal datum was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

ELEVATION DATUM: Flood elevations on the FIRM are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988**,** visit the National Geodetic Survey website at www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

Local vertical monuments may have been used to create the map. To obtain current monument information, please contact the appropriate local community listed in Table 31 of this FIS Report.

BASE MAP INFORMATION: Base map information shown on the FIRM was derived from Coastal California LiDAR and digital imagery dated 2011. USDA NAIP imagery dated 2010 is used in areas not covered by the Coastal California digital imagery. For information about base maps, refer to Section 6.2 “Base Map” in this FIS Report.

The map reflects more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables may reflect stream channel distances that differ from what is shown on the map.

Corporate limits shown on the map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after the map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Figure 2. FIRM Notes to Users

NOTES FOR FIRM INDEX

REVISIONS TO INDEX: As new studies are performed and FIRM panels are updated within San Mateo County, CA, corresponding revisions to the FIRM Index will be incorporated within the FIS Report to reflect the effective dates of those panels. Please refer to Table 28 of this FIS Report to determine the most recent FIRM revision date for each community. The most recent FIRM panel effective date will correspond to the most recent index date.

SPECIAL NOTES FOR SPECIFIC FIRM PANELS

This Notes to Users section was created specifically for San Mateo County, California**,** effective <date>**.**

ACCREDITED LEVEE: Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit www.fema.gov/national-flood-insurance-program.

PROVISIONALLY ACCREDITED LEVEE: Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To maintain accreditation, the levee owner or community is required to submit the data and documentation necessary to comply with Section 65.10 of the NFIP regulations by December 31, 2011. If the community or owner does not provide the necessary data and documentation or if the data and documentation provided indicate the levee system does not comply with Section 65.10 requirements, FEMA will revise the flood hazard and risk information for this area to reflect de-accreditation of the levee system. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit www.fema.gov/national-flood-insurance-program.

FLOOD RISK REPORT: A Flood Risk Report (FRR) may be available for many of the flooding sources and communities referenced in this FIS Report. The FRR is provided to increase public awareness of flood risk by helping communities identify the areas within their jurisdictions that have the greatest risks. Although non-regulatory, the information provided within the FRR can assist communities in assessing and evaluating mitigation opportunities to reduce these risks. It can also be used by communities developing or updating flood risk mitigation plans. These plans allow communities to identify and evaluate opportunities to reduce potential loss of life and property. However, the FRR is not intended to be the final authoritative source of all flood risk data for a project area; rather, it should be used with other data sources to paint a comprehensive picture of flood risk.

Each FIRM panel contains an abbreviated legend for the features shown on the maps. However, the FIRM panel does not contain enough space to show the legend for all map features. Figure 3 shows the full legend of all map features. Note that not all of these features may appear on the FIRM panels in San Mateo County.

Figure 3: Map Legend for FIRM

SPECIAL FLOOD HAZARD AREAS: *The 1% annual chance flood, also known as the base flood or 100-year flood, has a 1% chance of happening or being exceeded each year. Special Flood Hazard Areas are subject to flooding by the 1% annual chance flood. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights. See note for specific types. If the floodway is too narrow to be shown, a note is shown.*

	Special Flood Hazard Areas subject to inundation by the 1% annual chance flood (Zones A, AE, AH, AO, AR, A99, V and VE)
Zone A	The flood insurance rate zone that corresponds to the 1% annual chance floodplains. No base (1% annual chance) flood elevations (BFEs) or depths are shown within this zone.
Zone AE	The flood insurance rate zone that corresponds to the 1% annual chance floodplains. Base flood elevations derived from the hydraulic analyses are shown within this zone.
Zone AH	The flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot BFEs derived from the hydraulic analyses are shown at selected intervals within this zone.
Zone AO	The flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the hydraulic analyses are shown within this zone.
Zone AR	The flood insurance rate zone that corresponds to areas that were formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
Zone A99	The flood insurance rate zone that corresponds to areas of the 1% annual chance floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or flood depths are shown within this zone.
Zone V	The flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations are not shown within this zone.
Zone VE	Zone VE is the flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations derived from the coastal analyses are shown within this zone as static whole-foot elevations that apply throughout the zone.

Figure 3: Map Legend for FIRM

	Regulatory Floodway determined in Zone AE.
OTHER AREAS OF FLOOD HAZARD	
	Shaded Zone X: Areas of 0.2% annual chance flood hazards and areas of 1% annual chance flood hazards with average depths of less than 1 foot or with drainage areas less than 1 square mile.
	Future Conditions 1% Annual Chance Flood Hazard – Zone X: The flood insurance rate zone that corresponds to the 1% annual chance floodplains that are determined based on future-conditions hydrology. No base flood elevations or flood depths are shown within this zone.
	Area with Reduced Flood Risk due to Levee: Areas where an accredited levee, dike, or other flood control structure has reduced the flood risk from the 1% annual chance flood.
OTHER AREAS	
	Zone D (Areas of Undetermined Flood Hazard): The flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.
NO SCREEN	Unshaded Zone X: Areas of minimal flood hazard.
FLOOD HAZARD AND OTHER BOUNDARY LINES	
(ortho) (vector)	Flood Zone Boundary (white line on ortho-photography-based mapping; gray line on vector-based mapping)
	Limit of Study
	Jurisdiction Boundary
	Limit of Moderate Wave Action (LiMWA): Indicates the inland limit of the area affected by waves greater than 1.5 feet
GENERAL STRUCTURES	
Aqueduct Channel Culvert Storm Sewer	Channel, Culvert, Aqueduct, or Storm Sewer
Dam Jetty Weir	Dam, Jetty, Weir
	Levee, Dike, or Floodwall
Bridge	Bridge

Figure 3: Map Legend for FIRM

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AND OTHERWISE PROTECTED AREAS (OPA): *CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.*	
CBRS AREA 09/30/2009	Coastal Barrier Resources System Area: Labels are shown to clarify where this area shares a boundary with an incorporated area or overlaps with the floodway.
OTHERWISE PROTECTED AREA 09/30/2009	Otherwise Protected Area
REFERENCE MARKERS	
22.0	River mile Markers
CROSS SECTION & TRANSECT INFORMATION	
B 20.2	Lettered Cross Section with Regulatory Water Surface Elevation (BFE)
5280 21.1	Numbered Cross Section with Regulatory Water Surface Elevation (BFE)
17.5	Unlettered Cross Section with Regulatory Water Surface Elevation (BFE)
8	Coastal Transect
	Profile Baseline: Indicates the modeled flow path of a stream and is shown on FIRM panels for all valid studies with profiles or otherwise established base flood elevation.
	Coastal Transect Baseline: Used in the coastal flood hazard model to represent the 0.0-foot elevation contour and the starting point for the transect and the measuring point for the coastal mapping.
513	Base Flood Elevation Line
ZONE AE (EL 16)	Static Base Flood Elevation value (shown under zone label)
ZONE AO (DEPTH 2)	Zone designation with Depth
ZONE AO (DEPTH 2) (VEL 15 FPS)	Zone designation with Depth and Velocity

Figure 3: Map Legend for FIRM

BASE MAP FEATURES	
Missouri Creek	River, Stream or Other Hydrographic Feature
234	Interstate Highway
234	U.S. Highway
234	State Highway
234	County Highway
MAPLE LANE	Street, Road, Avenue Name, or Private Drive if shown on Flood Profile
RAILROAD	Railroad
	Horizontal Reference Grid Line
	Horizontal Reference Grid Ticks
+	Secondary Grid Crosshairs
Land Grant	Name of Land Grant
7	Section Number
R. 43 W. T. 22 N.	Range, Township Number
$^{42}76^{000m}$E	Horizontal Reference Grid Coordinates (UTM)
365000 FT	Horizontal Reference Grid Coordinates (State Plane)
80° 16’ 52.5”	Corner Coordinates (Latitude, Longitude)

SECTION 2.0 – FLOODPLAIN MANAGEMENT APPLICATIONS

2.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1% annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2% annual chance (500-year) flood is employed to indicate additional areas of flood hazard in the community.

Each flooding source included in the project scope has been studied and mapped using professional engineering and mapping methodologies that were agreed upon by FEMA and San Mateo County as appropriate to the risk level. Flood risk is evaluated based on factors such as known flood hazards and projected impact on the built environment. Engineering analyses were performed for each studied flooding source to calculate its 1% annual chance flood elevations; elevations corresponding to other floods (e.g. 10-, 4-, 2-, 0.2-percent annual chance, etc.) may have also been computed for certain flooding sources. Engineering models and methods are described in detail in Section 5.0 of this FIS Report. The modeled elevations at cross sections were used to delineate the floodplain boundaries on the FIRM; between cross sections, the boundaries were interpolated using elevation data from various sources. More information on specific mapping methods is provided in Section 6.0 of this FIS Report.

Depending on the accuracy of available topographic data (Table 23), study methodologies employed (Section 5.0), and flood risk, certain flooding sources may be mapped to show both the 1% and 0.2% annual chance floodplain boundaries, regulatory water surface elevations (BFEs), and/or a regulatory floodway. Similarly, other flooding sources may be mapped to show only the 1% annual chance floodplain boundary on the FIRM, without published water surface elevations. In cases where the 1% and 0.2% annual chance floodplain boundaries are close together, only the 1% annual chance floodplain boundary is shown on the FIRM.
Figure 3, "Map Legend for FIRM", describes the flood zones that are used on the FIRMs to account for the varying levels of flood risk that exist along flooding sources within the project area. Table 2 and Table 3 indicate the flood zone designations for each flooding source and each community within San Mateo County, CA, respectively.

Table 2, "Flooding Sources Included in this FIS Report," lists each flooding source, including its study limits, affected communities, mapped zone on the FIRM, and the completion date of its engineering analysis from which the flood elevations on the FIRM and in the FIS Report were derived. Descriptions and dates for the latest hydrologic and hydraulic analyses of the flooding sources are shown in Table 13. Floodplain boundaries for these flooding sources are shown on the FIRM (published separately) using the symbology described in Figure 3 On the map, the 1% annual chance floodplain corresponds to the SFHAs. The 0.2% annual chance floodplain shows areas that, although out of the regulatory floodplain, are still subject to flood hazards.

Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data. The procedures to remove these areas from the SFHA are described in Section 6.5 of this FIS Report.

Table 2: Flooding Sources Included in this FIS Report

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Alpine Creek	San Mateo County, Unincorporated Areas	Confluence with La Honda Creek	Approximately 3,180 feet upstream of Pescadero Road	18050006	1.1		N	A	
Ano Nuevo Creek	San Mateo County, Unincorporated Areas	At Cabrillo Highway	Approximately 1,800 feet upstream of Cabrillo Highway	18050006	0.3		N	A	
Apanolio Creek	San Mateo County, Unincorporated Areas	Confluence with Pilarcitos Creek	Approximately 1.7 miles upstream of San Mateo Road	18050006	1.9		N	A	
Arroyo de los Frijoles	San Mateo County, Unincorporated Areas	Approximately 4,200 feet upstream of Bean Hollow Road	Approximately 2.7 miles upstream of Bean Hollow Road	18050006	2.7		N	A	
Arroyo Leon	Half Moon Bay, City of; San Mateo County, Unincorporated Areas	Confluence with Pilarcitos Creek	Approximately 1,012 feet upstream of confluence of Mills Creek	18050006	2.2		N	A	
Atherton Creek	Menlo Park, City of	Approximately 345 feet downstream of US Highway 101	Approximately 103 feet upstream of Bayshore Freeway	18050004	0.1		N	A	
Bean Hollow Lakes	San Mateo County, Unincorporated Areas	Approximately 3.1 miles upstream of Bean Hollow Road	Approximately 4.2 miles upstream of Bean Hollow Road	18050006		0.08	N	A	

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Bear Gulch Creek	San Mateo County, Unincorporated Areas	Confluence with San Francisquito Creek	At Sand Hill Road	18050003	0.2		N	A	
Belmont Creek	Belmont, City of; San Carlos, City of; San Mateo Unincorporated Areas	At Bayshore Freeway	Approximately 3,240 feet upstream of Carlmont Drive	18050004	3.0		N	A	
Belmont Slough	Belmont, City of; Foster, City of; Redwood City, City of	Confluence with San Francisco Bay	Approximately 400 feet downstream of Shoreway Road	18050004	3.6		N	AE	
Bogess Creek	San Mateo County, Unincorporated Areas	Confluence with San Gregorio Creek	Approximately 2,400 feet upstream of La Honda Road	18050006	0.5		N	A	
Bradley Creek	San Mateo County, Unincorporated Areas	Approximately 1,550 feet upstream of confluence with Pescadero Creek	Approximately 1,630 feet upstream of confluence of Tahana Gulch	18050006	2.3		N	A	
Brittan Creek	San Carlos, City of	Confluence with Pulgas Creek	Approximately 700 feet upstream of Graceland Avenue	18050004	1.71		N	AE	
Burlingame Channel	Burlingame, City of	At Mission Street	Approximately 800 feet upstream of Occidental Avenue	18050004	0.3		N	A	
Burlingame Lagoon	Burlingame, City of	Confluence with San Francisco Bay	At Broadway Extension / Airport Boulevard	18050004		0.08	N	AE	

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Butano Creek	San Mateo County, Unincorporated Areas	Confluence with Pacific Ocean	Approximately 1,184 feet upstream of Pescadero Creek Road	18050006	2.2		Y	AE	
Butano Creek	San Mateo County, Unincorporated Areas	Approximately 1,184 feet upstream of Pescadero Creek Road	Approximately 3 miles upstream of confluence of Little Butano Creek	18050006	7.0		N	A	
Calera Creek	Pacifica, City of	Confluence with Pacific Ocean	Approximately 760 feet upstream of Modoc Place	18050006	1.5		N	A	
Cascade Creek	San Mateo County, Unincorporated Areas	Confluence with Pacific Ocean	Approximately 4,236 feet upstream of Cabrillo Highway	18050006	1.7		N	A	
Central Lake	Foster City, City of	Confluence with San Francisco Bay	Approximately 1.5 miles upstream of Beach Park Boulevard	18050004		0.3	N	A	
Chandler Gulch	San Mateo County, Unincorporated Areas	Confluence with Bradley Creek	Approximately 1,660 feet upstream of Stage Road	18050006	0.5		N	A	
Clear Creek	San Mateo County, Unincorporated Areas	Confluence with San Gregorio Creek	Approximately 4,640 feet upstream of La Honda Road	18050006	1.2		N	A	

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Colma Creek	South San Francisco, City of	Approximately 0.25 mile upstream of Lawndale Boulevard	Approximately 0.48 mile upstream of Lawndale Boulevard	18050004	0.23		N	AE	
Colma Creek	South San Francisco, City of	Approximately 1,470 feet upstream of Lawndale Boulevard	Approximately 2,690 feet upstream of Lawndale Boulevard	18050004	0.5		N	AE	
Colma Creek	South San Francisco, City of	Confluence with San Bruno Canal	Approximately 1,470 feet upstream of Lawndale Boulevard	18050004	3.3		N	A	
Cordilleras Creek	Redwood City, City of; San Carlos, City of; San Mateo County, Unincorporated Areas	Confluence with Steinberger Slough	Approximately 900 feet upstream of Alameda de Las Pulgas	18050004	1.95		N	AE, A	
Cordilleras Creek	San Mateo County, Unincorporated Areas	Approximately 740 feet downstream of Scenic Drive	Approximately 830 feet upstream of Scenic Drive	18050004	0.3		N	A	
Corinda Los Trancos Creek	San Mateo County, Unincorporated Areas	Confluence with Pilarcitos Creek	Approximately 3,480 feet upstream of San Mateo Road	18050006	0.7		N	A	

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Corte Madera Creek	Portola Valley, Town of; Woodside, Town of	Approximately 1 mile downstream of Westridge Drive	Approximately 0.75 mile upstream of Willowbrook Drive	18050003	2.74		N	AE	
Corte Madera Creek	Portola Valley, Town of	Approximately 0.75 mile upstream of Willowbrook Drive	Approximately 1.28 miles upstream of Willowbrook Drive	18050003	0.5		N	A	
Coyote Creek	San Mateo County, Unincorporated Areas	Confluence with San Gregorio Creek	Approximately 1,030 feet upstream of confluence with San Gregorio Creek	18050006	0.2		N	A	
Denniston Creek	San Mateo County, Unincorporated Areas	At mouth of Denniston Creek	Approximately 0.3 mile upstream of Farm Bridge	18050006	1.21		N	VE, AE	
Denniston Creek	San Mateo County, Unincorporated Areas	Approximately 0.75 mile upstream of State Highway 1	Approximately 2.45 miles upstream of State Highway 1	18050006	1.7		N	A	
Devonshire of Pulgas Creek	San Carlos, City of	Confluence with Pulgas Creek	Approximately 720 feet upstream of confluence with Pulgas Creek	18050004	0.1		N	AE	
Easton Creek	Burlingame, City of	Confluence with San Francisco Bay	Approximately 367 feet upstream of Bayshore Highway	18050004	0.05		N	AE	

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Easton Creek	Burlingame, City of	Approximately 367 feet upstream of Bayshore Highway	Approximately 160 feet upstream of Bernal Avenue	18050004	1.3		N	A, AH	
El Corte de Madera Creek	San Mateo County, Unincorporated Areas	Confluence with San Gregorio Creek	Approximately 1,877 feet upstream of Bear Gulch Road	18050006	3.2		N	A	
El Granada Creek	San Mateo County, Unincorporated Areas	At mouth of El Granada Creek	Approximately 750feet upstream of San Juan Avenue	18050006	0.7		N	AE	
El Portal Canal	Burlingame, City of; Millbrae, City of	At Bayshore Freeway	At Union Pacific Railroad	18050004	1.5		N	A	
Elliot Creek	San Mateo County, Unincorporated Areas	Confluence with Pacific Ocean	Approximately 950 feet upstream of Cabrillo Highway	18050006	0.2		N	A	
Finney Creek	San Mateo County, Unincorporated Areas	Confluence with Pacific Ocean	Approximately 1,300 feet upstream of Cabrillo Highway	18050006	0.3		N	A	
Frenchmans Creek	Half Moon Bay, City of; San Mateo County, Unincorporated Areas	Approximately 1,200 feet downstream of Cabrillo Highway North	Approximately 1.6 miles upstream of Cabrillo Highway North	18050006	1.8		N	A	
Gazos Creek	San Mateo County, Unincorporated Areas	Confluence with Pacific Ocean	Approximately 2,957 feet upstream of Cabrillo Highway	18050006	0.7		N	VE, A	

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Green Hills Creek	Millbrae, City of	Approximately 95 feet upstream of Helen Drive	Approximately 288 feet upstream of Helen Drive	18050004	0.03		N	A	
Green Oaks Creek	San Mateo County, Unincorporated Areas	Confluence with Pacific Ocean	Approximately 3,980 feet upstream of Cabrillo Highway	18050006	2.9		N	VE, A	
Hamms Gulch	Portola Valley, Town of	Confluence with Corte Madera Creek	Approximately 460 feet upstream of confluence with Corte Madera Creek	18050003	0.08		N	A	
Harbor Industrial District Channel	San Carlos, City of; Redwood City, City of	Confluence with Steinberger Slough	Approximately 630 feet upstream of Fairfield Drive	18050004	0.8		N	AE, A	
Harrington Creek	San Mateo County, Unincorporated Areas	Confluence with San Gregorio Creek	Approximately 1,000 feet upstream of confluence with San Gregorio Creek	18050006	0.2		N	A	
Honsinger Creek	San Mateo County, Unincorporated Areas	Approximately 680 feet upstream of confluence with Pescadero Creek	Approximately 3,090 feet upstream of Pescadero Creek Road	18050006	0.8		N	A	
La Honda Creek	San Mateo County, Unincorporated Areas	Confluence with San Gregorio Creek	Approximately 870 feet upstream of confluence with Woodhams Creek	18050006	1.44		Y	AE	

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Lake Lucerna	San Mateo County, Unincorporated Areas	At Bean Hollow Road	Approximately 4,370 feet upstream of Bean Hollow Road	18050006		0.04	N	A	
Laurel Creek	Foster City, City of	Approximately 275 feet downstream of State Highway 1	Approximately 0.3 mile upstream of Laurel Street	18050004	2.8		N	AE	
Little Butano Creek	San Mateo County, Unincorporated Areas	Confluence with Butano Creek	Approximately 450 feet upstream of Cloverdale Road	18050006	1.5		N	A	
Lomita Channel	Millbrae, City of; San Mateo County, Unincorporated Areas	At Bayshore Freeway	At Union Pacific Railroad	18050004	1.5		N	A	
Los Trancos Creek	San Mateo County, Unincorporated Areas	Approximately 1.3 miles downstream of Arastradero Road	Approximately 623 feet upstream of Los Trancos Road	18050003	2.3		N	A	
Madonna Creek	San Mateo County, Unincorporated Areas	Confluence with Pilarcitos Creek	Approximately 564 feet upstream of Pilarcitos Creek	18050006	0.1		N	A	
McCormick Creek	San Mateo County, Unincorporated Areas	Confluence with Pescadero Creek	Approximately 2,520 feet upstream of Pescadero Road	18050006	0.6		N	A	

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Middle Fork San Pedro Creek	Pacifica, City of; San Mateo County, Unincorporated Areas	Confluence with San Pedro Creek	Approximately 3,860 feet upstream of Oddstad Boulevard	18050006	0.8		N	A	
Milagra Creek	Pacifica, City of	Confluence with Pacific Ocean	Approximately 1,066 feet upstream of Edgemar Avenue	18050006	0.8		N	A	
Millbrae (High Line) Canal	Millbrae, City of	Approximately 930 feet downstream of South Ashton Avenue	Approximately 230 feet upstream of South Ashton Avenue	18050004	0.7		N	A	
Mills Creek	San Mateo County, Unincorporated Areas	Confluence with Arroyo Leon	Approximately 1.5 miles upstream of confluence with Arroyo Leon	18050006	1.5		N	A	
Montara Creek	San Mateo County, Unincorporated Areas	Approximately 460 feet downstream of State Highway 1	Approximately 1,080 feet upstream of Drake Street	18050006	1.89		N	AE	
O'Neill Slough	Belmont, City of; Foster City, City of; San Mateo, City of; Redwood City, City of	Confluence with Belmont Slough	Confluence of Marina Lagoon	18050004	0.8		N	AE, A	
Palmer Gulch	San Mateo County, Unincorporated Areas	Confluence with San Gregorio Creek	Approximately 1,250 feet upstream of La Honda Road	18050006	0.3		N	A	

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Pescadero Creek	San Mateo County, Unincorporated Areas	Approximately 107 feet downstream of State Highway 1	Approximately 1,790 feet upstream of Butano Cut Off Road	18050006	4.3		Y	AE	
Pescadero Creek	San Mateo County, Unincorporated Areas	Approximately 1,790 feet upstream of Butano Cut Off Road	Approximately 4 miles upstream of confluence of McCormick Creek	18050006	11.6		N	A	
Pilarcitos Creek	Half Moon Bay, City of; San Mateo County Unincorporated Areas	Confluence of Arroyo Leon	Approximately 524 feet upstream of Pilarcitos Creek Road	18050006	3.9		N	A	
Pomponio Creek	San Mateo County, Unincorporated Areas	Confluence with Pacific Ocean	Approximately 4 miles upstream of Stage Road	18050006	6.0		N	VE, A	
Pulgas Creek	San Carlos, City of	Confluence with Steinberger Slough	Approximately 179 feet downstream of Fay Avenue	18050004	2.2		N	AE, AO	
Purisima Creek	San Mateo County, Unincorporated Areas	Confluence with Pacific Ocean	Approximately 3.4 miles upstream of Verde Road	18050006	4.4		N	A	
Redwood Creek	Redwood City, City of	Confluence with San Francisco Bay	Approximately 45 feet upstream of Veterans Boulevard	18050004	3.6		N	AE	

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Redwood Creek	Redwood City, City of	Approximately 200 feet downstream of Main Street	Approximately 450 feet upstream of Lathrop Street	18050004	0.7		N	A	
Rockaway Creek	Pacifica, City of	Confluence with Pacific Ocean	Approximately 180 feet upstream of confluence with Pacific Ocean	18050006	0.03		N	VE, AE	
Rockaway Creek	Pacifica, City of	Approximately 200 feet downstream of Old County Road	Approximately 990 feet upstream of Troglia Terrace	18050006	0.9		N	A	
San Francisquito Creek	East Palo Alto, City of; Menlo Park, City of	Confluence with San Francisco Bay	Approximately 1 mile upstream from confluence with San Francisco Bay	18050004	1.0		N	AE	
San Francisquito Creek	East Palo Alto, City of; Menlo Park, City of	Approximately 1 mile upstream from confluence with San Francisco Bay	At San Mateo Drive	18050004	4.7		N	A	
San Gregorio Creek	San Mateo County, Unincorporated Areas	Approximately 119 feet downstream of Dirt Road	Approximately 0.6 mile upstream of confluence with La Honda Creek	18050006	2.35		Y	AE	
San Gregorio Creek	San Mateo County, Unincorporated Areas	At mouth	Approximately 1,374 feet upstream of confluence of Harrington Creek	18050006	10.3		N	A	
San Mateo Creek	Town of Hillsborough, City of San Mateo	Confluence with San Francisco Bay	Approximately 555 feet upstream of El Cerrito Avenue	18050004	3.7		Y	AE	

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
San Pedro Creek	Pacifica, City of	Confluence with Pacific Ocean	Approximately 700 feet upstream of Linda Mar Boulevard	18050006	2.2		N	A	
San Vicente Creek	San Mateo County, Unincorporated Areas	Approximately 160 feet downstream of Parking Lot	Approximately 1.1 miles upstream of Etheldore Street	18050006	1.8		N	AE	
San Vicente Creek	San Mateo County, Unincorporated Areas	Approximately 1.1 miles upstream of Etheldore Street	Approximately 1.7 miles upstream of Etheldore Street	18050006	0.6		N	A	
Sanchez Creek	Burlingame, City of	At Mission Street	Approximately 546 feet upstream of Drake Avenue	18050004	0.3		N	A	
Sausal Creek	Woodside, Town of	At Family Farm Road	Approximately 55 feet upstream of the confluence with Bull Run Creek	18050003	1.0		Y	AE	
Searsville Lake	San Mateo County, Unincorporated Areas	Approximately 1,554 feet upstream of Bear Gulch Creek	Approximately 3,300 feet upstream of Bear Gulch Creek	18050003		0.01	N	A	
Sharp Park Creek	Pacifica, City of	At mouth	Approximately 1,486 feet upstream of Lundy Way	18050006	0.9		N	A	

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Tahana Gulch	San Mateo County, Unincorporated Areas	Confluence with Bradley Creek	Approximately 1,400 feet upstream of confluence with Bradley Creek	18050006	0.2		N	A	
Tunitas Creek	San Mateo County, Unincorporated Areas	Confluence with Pacific Ocean	Approximately 208 feet upstream of confluence of Dry Creek	18050006	0.6		N	VE, A	
West Union Creek	Woodside, Town of	Confluence with Bear Gulch Creek	Confluence with Tripp Gulch	18050003	0.8		N	AE	
Woodhams Creek	San Mateo County, Unincorporated Areas	Confluence with La Honda Creek	Approximately 8 feet upstream of Esmeralda Terrace	18050006	0.55		N	AE	
Yankee Jim Gulch	San Mateo County, Unincorporated Areas	Confluence with Pacific Ocean	Approximately 1,739 feet upstream of confluence with Pacific Ocean	18050006	0.3		N	VE, A	

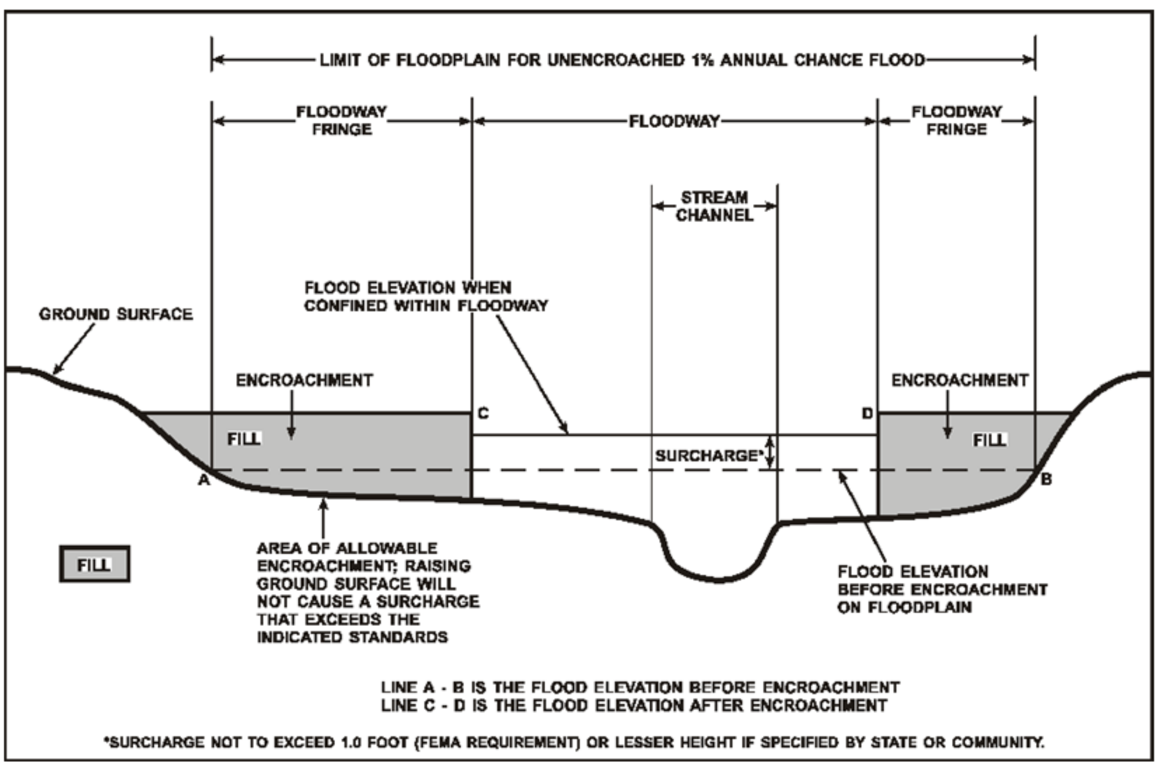
2.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard.

For purposes of the NFIP, a floodway is used as a tool to assist local communities in balancing floodplain development against increasing flood hazard. With this approach, the area of the 1% annual chance floodplain on a river is divided into a floodway and a floodway fringe based on hydraulic modeling. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment in order to carry the 1% annual chance flood. The floodway fringe is the area between the floodway and the 1% annual chance floodplain boundaries where encroachment is permitted. The floodway must be wide enough so that the floodway fringe could be completely obstructed without increasing the water surface elevation of the 1% annual chance flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 4.

To participate in the NFIP, Federal regulations require communities to limit increases caused by encroachment to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this project are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway projects.

Figure 4: Floodway Schematic



Floodway widths presented in this FIS Report and on the FIRM were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. For certain stream segments, floodways were adjusted so that the amount of floodwaters conveyed on each side of the floodplain would be reduced equally. The results of the floodway computations have been tabulated for selected cross sections and are shown in Table 24, “Floodway Data.”

All floodways that were developed for this Flood Risk Project are shown on the FIRM using the symbology described in Figure 3 In cases where the floodway and l% annual chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown on the FIRM. For information about the delineation of floodways on the FIRM, refer to Section 6.3.

2.3 Base Flood Elevations

The hydraulic characteristics of flooding sources were analyzed to provide estimates of the elevations of floods of the selected recurrence intervals. The Base Flood Elevation (BFE) is the elevation of the 1% annual chance flood. These BFEs are most commonly rounded to the whole foot, as shown on the FIRM, but in certain circumstances or locations they may be rounded to 0.1 foot. Cross section lines shown on the FIRM may also be labeled with the BFE rounded to 0.1 foot. Whole-foot BFEs derived from engineering analyses that apply to coastal areas, areas of ponding, or other static areas with little elevation change may also be shown at selected intervals on the FIRM.

Cross sections with BFEs shown on the FIRM correspond to the cross sections shown in the Floodway Data table and Flood Profiles in this FIS Report. BFEs are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS Report in conjunction with the data shown on the FIRM.

2.4 Non-Encroachment Zones

Some States and communities use non-encroachment zones to manage floodplain development. For flooding sources with medium flood risk, field surveys are often not collected and surveyed bridge and culvert geometry is not developed. Standard hydrologic and hydraulic analyses are still performed to determine BFEs in these areas. However, floodways are not typically determined, since specific channel profiles are not developed. To assist communities with managing floodplain development in these areas, a “non-encroachment zone” may be provided. While not a FEMA designated floodway, the non-encroachment zone represents that area around the stream that should be reserved to convey the 1% annual chance flood event. As with a floodway, all surcharges must fall within the acceptable range in the non-encroachment zone.

General setbacks can be used in areas of lower risk (e.g. unnumbered Zone A), but these are not considered sufficient where unnumbered Zone A is replaced by Zone AE. The NFIP requires communities to ensure that any development in a non-encroachment area causes no increase in BFEs. Communities must generally prohibit development within the area defined by the non-encroachment width to meet the NFIP requirement.

Non-encroachment determinations may be delineated where it is not possible to delineate floodways because specific channel profiles with bridge and culvert geometry were not developed. Any non-encroachment determinations for this Flood Risk Project have been tabulated for selected cross sections and are shown in Table 25, “Flood Hazard and Non-Encroachment

Data for Selected Streams." Areas for which non-encroachment zones are provided show BFEs and the 1% annual chance floodplain boundaries mapped as zone AE on the FIRM but no floodways.

2.5 Coastal Flood Hazard Areas

For most areas along rivers, streams, and small lakes, BFEs and floodplain boundaries are based on the amount of water expected to enter the area during a 1% annual chance flood and the geometry of the floodplain. Floods in these areas are typically caused by storm events. However, for areas on or near ocean coasts, large rivers, or large bodies of water, BFE and floodplain boundaries may need to be based on additional components, including storm surges and waves. Communities on or near ocean coasts face flood hazards caused by offshore seismic events as well as storm events.

Coastal flooding sources that are included in this Flood Risk Project are shown in Table 2.

2.5.1 Water Elevations and the Effects of Waves

Specific terminology is used in coastal analyses to indicate which components have been included in evaluating flood hazards.

The stillwater elevation (SWEL or still water level) is the surface of the water resulting from astronomical tides, storm surge, and freshwater inputs, but excluding wave setup contribution or the effects of waves.

- *Astronomical tides* are periodic rises and falls in large bodies of water caused by the rotation of the earth and by the gravitational forces exerted by the earth, moon and sun.
- *Storm surge* is the additional water depth that occurs during large storm events. These events can bring air pressure changes and strong winds that force water up against the shore.
- *Freshwater inputs* include rainfall that falls directly on the body of water, runoff from surfaces and overland flow, and inputs from rivers.

The 1% annual chance stillwater elevation is the stillwater elevation that has been calculated for a storm surge from a 1% annual chance storm. The 1% annual chance storm surge can be determined from analyses of tidal gage records, statistical study of regional historical storms, or other modeling approaches. Stillwater elevations for storms of other frequencies can be developed using similar approaches.

The total stillwater elevation (also referred to as the mean water level) is the stillwater elevation plus wave setup contribution but excluding the effects of waves.

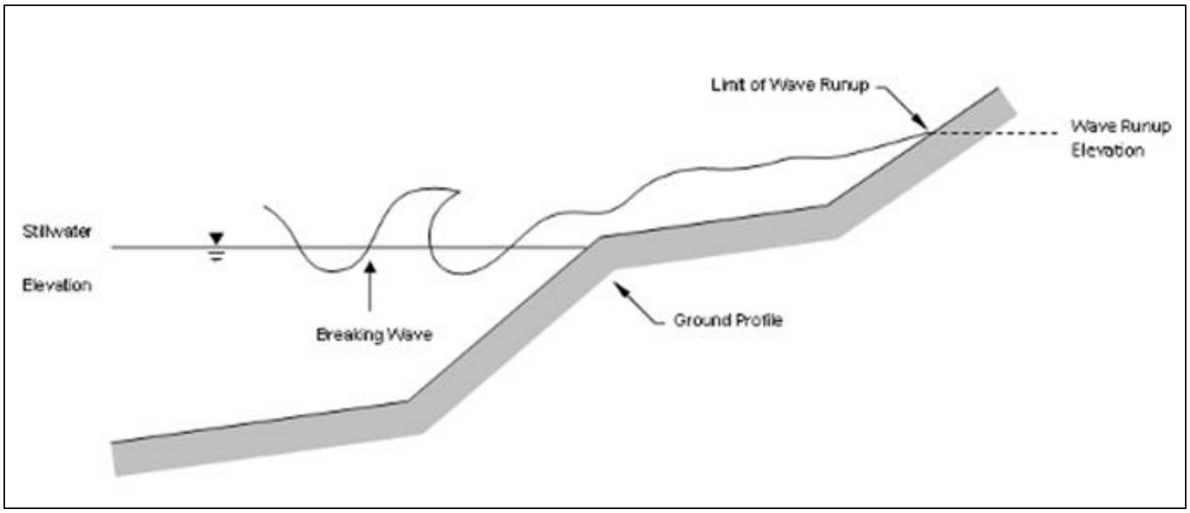
- *Wave setup* is the increase in stillwater elevation at the shoreline caused by the reduction of waves in shallow water. It occurs as breaking wave momentum is transferred to the water column.

Like the stillwater elevation, the total stillwater elevation is based on a storm of a particular frequency, such as the 1% annual chance storm. Wave setup is typically estimated using standard engineering practices or calculated using models, since tidal gages are often sited in areas sheltered from wave action and do not capture this information.

Coastal analyses may examine the effects of overland waves by analyzing storm-induced erosion, overland wave propagation, wave runup, and/or wave overtopping.

- *Storm-induced erosion* is the modification of existing topography by erosion caused by a specific storm event, as opposed to general erosion that occurs at a more constant rate.
- *Overland wave propagation* describes the combined effects of variation in ground elevation, vegetation, and physical features on wave characteristics as waves move onshore.
- *Wave runup* is the uprush of water from wave action on a shore barrier. It is a function of the roughness and geometry of the shoreline at the point where the stillwater elevation intersects the land.
- *Wave overtopping* refers to wave runup that occurs when waves pass over the crest of a barrier.

Figure 5: Wave Runup Transect Schematic



2.5.2 Floodplain Boundaries and BFEs for Coastal Areas

For coastal communities along the Atlantic and Pacific Oceans, the Gulf of Mexico, the Great Lakes, and the Caribbean Sea, flood hazards must take into account how storm surges, waves, and extreme tides interact with factors such as topography and vegetation. Storm surge and waves must also be considered in assessing flood risk for certain communities on rivers or large inland bodies of water.

Beyond areas that are affected by waves and tides, coastal communities can also have riverine floodplains with designated floodways, as described in previous sections.

Floodplain Boundaries

In many coastal areas, storm surge is the principle component of flooding. The extent of the 1% annual chance floodplain in these areas is derived from the total stillwater elevation (stillwater elevation including storm surge plus wave setup) for the 1% annual chance storm. The methods that were used for calculation of total stillwater elevations for coastal areas are described in Section 5.3 of this FIS Report. Location of total stillwater elevations for coastal areas are shown in Figure 8, “1% Annual Chance Total Stillwater Levels for Coastal Areas.”

In some areas, the 1% annual chance floodplain is determined based on the limit of wave runup or wave overtopping for the 1% annual chance storm surge. The methods that were used for calculation of wave hazards are described in Section 5.3 of this FIS Report.

Table 26 presents the types of coastal analyses that were used in mapping the 1% annual chance floodplain in coastal areas.

Coastal BFEs

Coastal BFEs are calculated as the total stillwater elevation (stillwater elevation including storm surge plus wave setup) for the 1% annual chance storm plus the additional flood hazard from overland wave effects (storm-induced erosion, overland wave propagation, wave runup and wave overtopping).

Where they apply, coastal BFEs are calculated along transects extending from offshore to the limit of coastal flooding onshore. Results of these analyses are accurate until local topography, vegetation, or development type and density within the community undergoes major changes.

Parameters that were included in calculating coastal BFEs for each transect included in this FIS Report are presented in Table 17, "Coastal Transect Parameters." The locations of transects are shown in Figure 9, "Transect Location Map." More detailed information about the methods used in coastal analyses and the results of intermediate steps in the coastal analyses are presented in Section 5.3 of this FIS Report. Additional information on specific mapping methods is provided in Section 6.4 of this FIS Report.

2.5.3 Coastal High Hazard Areas

Certain areas along the open coast and other areas may have higher risk of experiencing structural damage caused by wave action and/or high-velocity water during the 1% annual chance flood. These areas will be identified on the FIRM as Coastal High Hazard Areas.

- *Coastal High Hazard Area (CHHA)* is a SFHA extending from offshore to the inland limit of the primary frontal dune (PFD) or any other area subject to damages caused by wave action and/or high-velocity water during the 1% annual chance flood.
- *Primary Frontal Dune (PFD)* is a continuous or nearly continuous mound or ridge of sand with relatively steep slopes immediately landward and adjacent to the beach. The PFD is subject to erosion and overtopping from high tides and waves during major coastal storms.

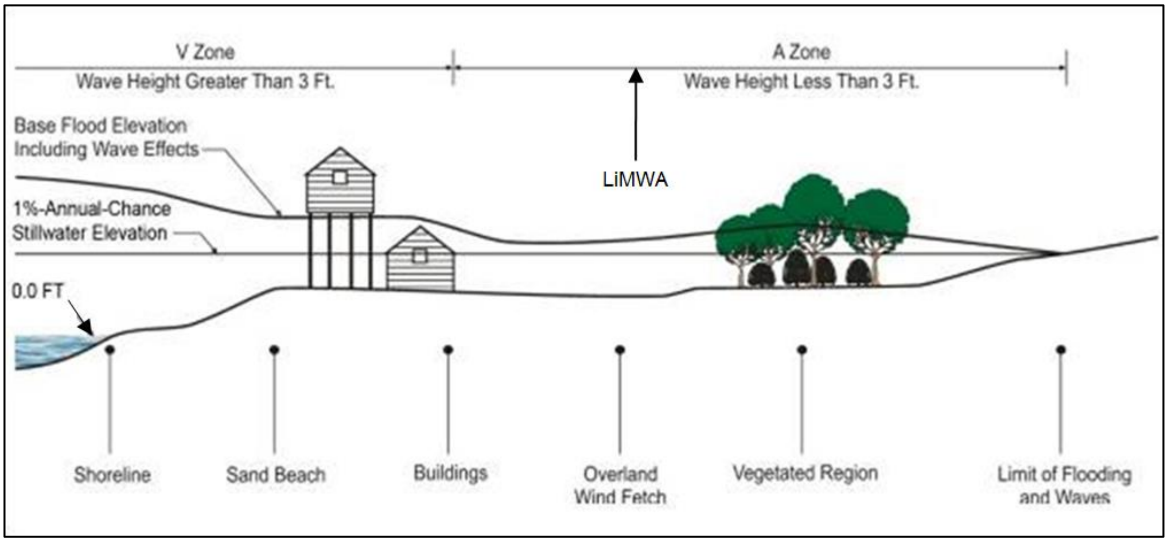
CHHAs are designated as "V" zones (for "velocity wave zones") and are subject to more stringent regulatory requirements and a different flood insurance rate structure. The areas of greatest risk are shown as VE on the FIRM. Zone VE is further subdivided into elevation zones and shown with BFEs on the FIRM.

The landward limit of the PFD occurs at a point where there is a distinct change from a relatively steep slope to a relatively mild slope; this point represents the landward extension of Zone VE. Areas of lower risk in the CHHA are designated with Zone V on the FIRM. More detailed information about the identification and designation of Zone VE is presented in Section 6.4 of this FIS Report.

Areas that are not within the CHHA but are SFHAs may still be impacted by coastal flooding and damaging waves; these areas are shown as "A" zones on the FIRM.

Figure 6, “Coastal Transect Schematic,” illustrates the relationship between the base flood elevation, the 1% annual chance stillwater elevation, and the ground profile as well as the location of the Zone VE and Zone AE areas in an area without a PFD subject to overland wave propagation. This figure also illustrates energy dissipation and regeneration of a wave as it moves inland.

Figure 6: Coastal Transect Schematic



Methods used in coastal analyses in this Flood Risk Project are presented in Section 5.3 and mapping methods are provided in Section 6.4 of this FIS Report.

Coastal floodplains are shown on the FIRM using the symbology described in Figure 3, “Map Legend for FIRM.” In many cases, the BFE on the FIRM is higher than the stillwater elevations shown in Table 17 due to the presence of wave effects. The higher elevation should be used for construction and/or floodplain management purposes.

2.5.4 Limit of Moderate Wave Action

This section is not applicable to this Flood Risk Project.

SECTION 3.0 – INSURANCE APPLICATIONS

3.1 National Flood Insurance Program Insurance Zones

For flood insurance applications, the FIRM designates flood insurance rate zones as described in Figure 3, “Map Legend for FIRM.” Flood insurance zone designations are assigned to flooding sources based on the results of the hydraulic or coastal analyses. Insurance agents use the zones shown on the FIRM and depths and base flood elevations in this FIS Report in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

The 1% annual chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (e.g. Zones A, AE, V, VE, etc.), and the 0.2% annual chance floodplain boundary corresponds to the boundary of areas of additional flood hazards.

Table 3 lists the flood insurance zones in San Mateo County.

Table 3: Flood Zone Designations by Community

Community	Flood Zone(s)
Atherton, Town of	X
Belmont, City of	A, AE, D, X
Brisbane, City of	A, X
Burlingame, City of	A, AE, AH, X
Colma, Town of	AE, AO, X
Daly City, City of	VE, X
East Palo Alto, City of	A, AE, X
Foster City, City of	A, AE, X
Half Moon Bay, City of	A, VE, X
Hillsborough, Town of	AE, X
Menlo Park, City of	A, AE, X
Millbrae, City of	A, AH, D, X
Pacifica, City of	A, AE, AH, D, VE, X
Portola Valley, Town of	A, AE, X
Redwood City, City of	A, AE, AO, D, X
San Bruno, City of	A, AH, D, X
San Carlos, City of	A, AE, AO, D, X
San Mateo County, Unincorporated Areas	A, AE, AH, AO, D, VE, X
San Mateo, City of	A, AE, X
South San Francisco, City of	A, AE, AH, AO, D, X
Woodside, Town of	A, AE, AO, D, X

3.2 Coastal Barrier Resources System

This section is not applicable to this Flood Risk Project.

Table 4: Coastal Barrier Resources System Information

[Not Applicable to this Flood Risk Project]

SECTION 4.0 – AREA STUDIED

4.1 Basin Description

Table 5 contains a description of the characteristics of the HUC-8 sub-basins within which each community falls. The table includes the main flooding sources within each basin, a brief description of the basin, and its drainage area.

Table 5: Basin Characteristics

HUC-8 Sub-Basin Name	HUC-8 Sub-Basin Number	Primary Flooding Source	Description of Affected Area	Drainage Area (square miles)
Coyote	18050003	San Francisquito Creek	San Mateo County has a flood control zone for the entire San Francisquito Creek drainage basin.	
San Francisco Bay	18050004	San Francisco Bay	Flooding in South San Francisco is aggravated by the existing channel floodwalls and levees, which prevent the 1-percent annual chance overbank flows from re-entering the channel.	
San Francisco Coastal South	18050006	Pacific Ocean	*	
Monterey Bay	18050015	*	*	

*Data not available

4.2 Principal Flood Problems

Table 6 contains a description of the principal flood problems that have been noted for San Mateo County by flooding source.

Table 6: Principal Flood Problems

Flooding Source	Description of Flood Problems
All sources	Past records and hydraulic analysis indicate that flooding will be predominately shallow along streams on the bayside of San Mateo County. Spills from the respective channels flow independently through the urbanized areas, usually following the streets, and result in flood depths of less than 1 foot. Occasionally, railroad or highway embankments form barriers, resulting in deeper ponding or sheetflow flooding. Flooding on the oceanside of the county is predominately confined to well-defined riverine valleys, with flood surface extending uniformly across the floodplain.
Colma Creek	The Daly City stormdrain terminates in a junction structure near the intersection of F Street and El Camino Real. Because the downstream

Flooding Source	Description of Flood Problems
Colma Creek, continued	stormdrain has only one-half the waterway area of the upstream stormdrain, the excess flow is forced from the stormdrain through a side channel into the Colma Mobile Home Park on the northwestern side of the intersection, where it ponds.
San Bruno, Crystal Springs, and Lomita Channels	The shallow flooding zones between the Bayshore Freeway and the mainline of the railroad are the result of overland flows from San Bruno Channel and Crystal Springs Channel. These flows merge behind the railroad embankment and eventually cross the railroad tracks as independent flows. Approximately 220 cubic feet per second (cfs) flow into the area north and west of the Crystal Springs Channel and are then pumped into the channel at a rate of approximately 35 cfs. (The Crystal Springs Channel itself has a capacity of 200 cfs and is adequate for the flows reaching it.) Approximately 740 cfs flow into the area south of the Crystal Springs Channel and west of the Bayshore Freeway. This flow moves southward until it reaches Lomita Channel, where it is then pumped into the Millbrae (High Line) Canal and flows to San Francisco Bay. The Crystal Springs Channel (200-cfs flow) and the Belle Air stormdrain (750-cfs flow) merge at San Bruno Avenue and flow northeasterly to San Francisco Bay in the San Bruno Channel (1,000-cfs flow), The shallow flooding zone adjacent to the San Bruno Channel is caused by local runoff.
Belmont Creek and Holly Street Channel	Overflows from Belmont Creek in the City of Belmont flow generally toward Francisco Bay. This overland flow can follow a myriad of routes, and the entire area on the bayside of the railroad tracks is subject to shallow flooding. At the railroad, the overland flow is split and the greater part is diverted to the east. Additional overflow occurs near Harbor Street and Old County Road at a railroad loading spur. The Bayshore Freeway and Holly Street off-ramp form a barrier to the easterly flow, causing shallow ponding in the Industrial Way area. This ponding has been greatly reduced by recently completed drainage projects.
San Francisquito Creek	San Francisquito Creek overflows at two locations within the City of Menlo Park. The overflow travels eastward toward the bay along streets leading away from the creek channel. At the Bayshore Freeway, this shallow flooding crosses into the county area and continues to flow toward the bay. There are no other spills from San Francisquito Creek into the county area. However, tidal flooding from the bay during the 1-percent annual chance flood can possibly overtop the levee system in the City of East Palo Alto and cause flooding in the residential area adjacent to San Francisquito Creek. Flooding has resulted in this area as a result of inadequate or nonexistent storm water facilities causing local storm waters to be trapped in the area. More information about flooding along this creek is described sections for the Cities of East Palo Alto and Menlo Park below.
Montara Creek	Montara Creek is generally confined to its channel, with overtopping occurring at most culvert crossings. The culvert at Harte Street is heavily silted, forcing the water out of the channel and over the road; a few residences are affected in the process. The embankment at State Highway 1 forms a dam, resulting in deep flooding; however, no existing structures are affected.
San Vicente Creek	San Vicente Creek overflows to the north at Etheldore Street, causing shallow flooding through several existing structures adjacent to State Highway 1 before

Flooding Source	Description of Flood Problems
San Vicente Creek, continued	the overflow returns to the channel along Cypress Avenue. Additional flooding occurs near the ocean front because of inadequate culvert capacity.
Denniston Creek	Denniston Creek is contained within a well-defined channel until it reaches State Highway 1, where limited culvert capacity results in shallow overflow and ponding southward behind the highway to a low point near Sonora Avenue, where it flows overland to the ocean. The channel through the developed part of Princeton is overgrown and culverts are of limited capacity; however, the resulting flooding is minimal.
El Granada Creek	El Granada Creek consists of a very shallow channel through the most developed oceanside area of the county. In numerous places, undersized culverts have been placed in the channel, causing general flooding of roads and residences in the vicinity of the creek. This flooding is contained by the remnants of the natural floodplain through the community.
Woodhams, La Honda, Alpine, and San Gregorio Creeks	All creeks in the La Honda community follow in well-defined and often steep channels. Flooding occurs across various stream terraces that are adjacent to culverts or channel restrictions. On San Gregorio Creek, a combination of meandering channel and numerous private bridges creates similar terrace flooding situations.
Pescadero and Butano Creeks	Pescadero and Butano Creeks are located in a classic river valley formed by the joining of two large drainages. Each creek has a well-defined channel that meanders through a broad floodplain bounded by hills on either side of the valley. This broad floodplain has little gradient and, therefore, is inundated by overflows from Pescadero Creek and the joining flows of Butano Creek. Most of the Town of Pescadero is built in this floodplain and is inundated during floods. The U.S. Army Corps of Engineers (USACE) estimated the cost of damage in Pescadero caused by the December 1955 flooding of roads, bridges, and 15 homes to have been $352,000, including rescue and emergency efforts (Reference 6). The 1998 Flood event brought record floods to this watershed. Over 6 inches of rain fell over two days and a peak flow of 10,600 cfs at the USGS gage on Pescadero Creek. High water marks taken after the flood show a flood elevation of 14.6 feet just downstream of the Pescadero Creek Road bridge.
Pacific Ocean	Flooding from the Pacific Ocean at Miramar and Martins Beaches is typically associated with the simultaneous occurrence of very high tides, large waves, and storm swells during the winter. As a result, ocean-front development has not been compatible with the natural instability of the shoreline and the intense winter weather. Tsunami (sea waves generated from oceanic earthquakes, submarine landslides, and volcanic eruptions) create some of the most destructive natural water waves. As tsunami waves approach shallow coastal waters, wave refraction, shoaling, and bay resonance amplify the wave heights. Storm centers from the southwest produce the type of storm pattern most commonly responsible for the majority of the serious coastal flooding. The strong winds and high tides that create storm surges are also accompanied by heavy rains. In some instances, high tides back up riverflows, which cause flooding at the river mouths.

Flooding Source	Description of Flood Problems
Pacific Ocean, continued	The most severe storms to hit the California coast occurred in 1978 and 1983, when high water levels were accompanied by very large storm waves. In January 1978, a series of storms emanated from a more southerly direction than normal; consequently, some of the better-protected beaches were also damaged. Jetties and breakwater barriers in the area were overtopped and in some cases undermined. Direct wave damage occurred to many beachfront homes. Accelerated erosion coupled with saturated ground conditions and rain weakened the foundations of homes located on the top of beach bluffs. Seawalls and temporary barriers failed to protect beach front properties from the ravages of the 1978 storms. The winter of 1983 brought an extremely unusual series of high tides, storm surges, and storm waves (Reference 4) which caused considerable damage along the northern California coast. More information about Pacific Ocean flooding is described in the sections for the Cities of Half Moon Bay and Pacifica below.
Sources within the City of Burlingame	Rainfall is the principal cause of flooding in Burlingame. Stream segments above El Camino Real consist of natural channels, partially improved channels, and various culverts. Most of these are inadequate for conveying a 1-percent annual chance flood event. Major flood damage has not occurred because streets parallel to the streams prevent surface flows from entering them. When the streamflows encounter an undersized culvert, the overflow proceeds along the almost-level cross streets to the steeper parallel streets leading to El Camino Real. From El Camino Real to the railroad, the streams, with the exception of Mills Creek, have been obliterated by development and the flows have been routed through underground stormdrains. Because of the low topographic relief and an abundance of streets able to carry floodflows, 1-percent annual chance flooding throughout this area is predominantly shallow. The railroad embankment causes ponding in the vicinity of Grove Avenue and California Drive and in the vicinity of Sanchez Avenue and California Drive. From the railroad to U.S. Highway 101 (the Bayshore Freeway), Mills Creek and Easton Creek are carried in improved channels into which much of the local drainage must be pumped. The other study streams continue to San Francisco Bay in underground stormdrains. None of these facilities is adequate to convey the 1-percent annual chance flood event. Except for the primary stormdrains that extend beyond the Bayshore Freeway, flooding sources become unidentifiable below the railroad embankment, mingling, spreading, and ponding over a large area. High Tides in San Francisco Bay can cause flooding between the Crown Plaza Hotel and the northbound US Highway 101 off-ramp. During the 1973 storm, bay tides approached the estimated 1-percent annual chance tidal level. This produced shallow flooding along Bayshore Highway between Mills Creek and El Portal Canal. To the south, existing levees along San Francisco Bay and Burlingame Lagoon protected that area from up to 7 feet of flooding.
Sources within the City of East Palo Alto	Flooding within the City of East Palo Alto is caused by heavy rainfall which generally occurs during winter and early spring and by high tides associated with storms. In December of 1955, San Francisquito Creek overtopped its banks at two locations west of East Palo Alto in the adjacent City of Menlo Park. The

Flooding Source	Description of Flood Problems
Sources within the City of East Palo Alto, continued	perched nature of the creek does not allow spilled water to flow back into the channel. As floodwaters rise above the banks, they flow northward and eastward towards San Francisco Bay. This shallow flooding inundates a portion of East Palo Alto from the Bayshore Freeway northward past the corporate limits near Alberni Street. The flooding in January 1973 was primarily caused by high tides in San Francisco Bay, concurrent with a 5-year storm. The maximum tide level was estimated to have a 1-percent annual chance recurrence interval. The tides inundated vast areas of low relief along the Bayfront and submerged streets in the University Village area. 1-percent annual chance floodflow in San Francisquito Creek is contained in the channel in East Palo Alto. However, tidal flooding from the bay circumvents the incomplete levee system near the bay and causes flooding in the residential area adjacent to San Francisquito Creek on the east side of the city. The 1989 flood event placed Bell Street Park underwater. On February 2-3, 1998, San Francisquito Creek overbanked at numerous locations in San Mateo and Santa Clara Counties, which lead to widespread flooding in the Cities of East Palo Alto, Palo Alto and Menlo Park. Approximately 1,700 homes were damaged at a cost of $28 million. The flow rate at the USGS streamflow station near the Stanford golf course was estimated by the USGS to be between 6,500 cfs and 8,000 cfs. This is the highest flowrate ever recorded at that station since its installment in the 1930s. The previous historic record was 5,560 cfs in 1955. Commuting and transportation were severely limited due to the closure of the Bayshore Freeway (US Highway 101) and other major arteries. USGS records indicate that this flood was a 2-percent annual chance flood.
Sources within the City of Half Moon Bay	Flooding from the Pacific ocean at Half Moon Bay is typically associated with the simultaneous occurrence of very high tides, large waves, and storm swells during the winter. As a result, ocean-front development has not been compatible with the natural instability of the shoreline and the intense winter weather. Tsunami (sea waves generated from oceanic earthquakes, submarine landslides, and volcanic eruptions) create some of the most destructive natural water waves, As tsunami waves approach shallow coastal waters, wave refraction, shoaling, and bay resonance amplify the wave heights. Storm centers from the southwest produce the type of storm pattern most commonly responsible for the majority of the serious coastal flooding. The strong winds and high tides that create storm surges are also accompanied by heavy rains. In some instances, high tides back up riverflows, which causes flooding at the river mouth. The most severe storms to hit the California coast occurred in 1978 and 1983, when high water levels were accompanied by very large storm waves. In January 1978, a series of storms emanated from a more southerly direction than normal; consequently, some of the better protected beaches were also damaged. Jetties and breakwater barriers in the area were overtopped and in some cases undermined. Direct wave damage occurred to many beach-front homes. Accelerated erosion coupled with saturated ground conditions and rain weakened the foundations of homes located on the top of beach bluffs. Seawalls and temporary barriers failed to protect beach-front properties from

Flooding Source	Description of Flood Problems
Sources within the City of Half Moon Bay, continued	the ravages of the 1978 storms.
Sources within the Town of Hillsborough	The past history flooding on San Mateo Creek indicates that flooding generally occurs during the winter or early spring. Major floods occurred in February 1940, December 1955, April 1958, and January 1973. The 1955 flood was the largest recorded for the periods 1930 to 1941 and 1950 to 1991 based on the flow records of San Francisquito Creek, located 5 miles south of the City of San Mateo (Reference 7). Hydraulic analyses indicate that during a 1-percent annual chance flood event, San Mateo Creek will overflow its channel in the vicinity of El Camino Real and that this spill would flow through yards and streets, resulting in shallow flooding with average depths of less than 1 foot. This flooding would collect behind the San Mateo levees before being pumped back into the bay. The analyses also indicate that San Mateo Creek will overflow its channel in the vicinity of Highway 101, resulting in flooding of the area lying east of the freeway.
Sources within the City of Menlo Park	Flooding within Menlo Park is caused by heavy rainfall which generally occurs during the winter and early spring by high tides associated with storms. Major floods, since the development of the city, have occurred in February 1940, December 1955, April 1958, January 1967, January 1973 and most recently in February 1998. The 1955 flood has an estimated recurrence interval of 25 years. During this flood, San Francisquito Creek overtopped its banks at Middlefield Road and Pope Street, causing evacuation of residents along the creek. The perched nature of the creek does not allow spilled water to flow back into the channel. As floodwaters rise above the banks, they will flow away from the channel and toward the bay through Menlo Park and the City of East Palo Alto. The flooding in January 1973 was primarily caused by high tides in San Francisco Bay, concurrent with a 5-year storm. The maximum tide level was estimated to have a 1-percent annual chance recurrence interval. The tides inundated vast areas of low relief along the bay front that are not protected by levees and along Haven Avenue where exiting levees were overtopped. Flooding due to rainfall in the areas of low relief close to the bay is aggravated by high tides which back up the storm-drain network and drainage of storm runoff. Many of the houses in these areas are built with the first floor slab on grade; thus flooding with depths of less than 1 foot can enter these houses. The majority of Atherton Creek within Menlo Park is underground and therefore, flooding has been limited to broad shallow street flow and local ponding. This is due to extensive flooding and resulting flow reduction that occurs upstream of the corporate limits.
Sources within the City of Millbrae	Rainfall is the principal cause of flooding in Millbrae. During the storm of January 1973, as measured at the Colma Creek stream gage 4 miles to the north, the resulting flood has a recurrence interval of approximately 15 years. Major storms also occurred in 1956, 1958, 1967, and 1971. The most recent storm of significance occurred during the winter 1998, causing flooding around the Westin and clarion Hotels and landslides in the areas of Sleepy Hollow, Clearfield and Morningside.

Flooding Source	Description of Flood Problems
Sources within the City of Millbrae, continued	Because of floodplain encroachment, there are various areas in Millbrae which have historically been subjected to local flooding, including Helen Drive west of Laurel Avenue and Landing Lane. El Camino Real is generally subject to flooding wherever it crosses a historic stream channel. In the absence of well-defined drainage channels, these areas of local flooding are the areas which are most severely affected by a major rainfall event. During such an event, when local storm-drain capacities are exceeded, floodflows make their way toward San Francisco Bay by various overland routes. However, the embankment of the railroad forms an effective barrier to this eastward movement of water. In the vicinity of Landing Lane, a high railroad embankment and inadequate culverts cause appreciable flooding. During the 1-percent annual chance flood event, this ponding behind the railroad embankment would provide enough storage to reduce significantly the downstream ponding where Lomita Channel (Lornita Creek) is pumped into Millbrae (High Line) Canal. This pump/storage relationship at Millbrae Canal would be extremely sensitive to any future upstream improvements to relieve the flooding situation at Landing Lane. Also important would be any change in the pump/storage relationship caused by encroachment upon the undeveloped area adjacent to Lomita Channel upstream of the pump station. Development upon this storage area could substantially reduce its effectiveness. Assuming that the existing stormdrains operate properly, the flooding from a major storm would be shallow and localized for the remaining areas of Millbrae. There is no indication that San Francisco Bay cause significant tidal flooding problems within the City of Millbrae. The 1973 storm resulted in elevations approaching the estimated 1-percent annual chance tidal level.
Sources within the City of Pacifica	Flooding in Pacifica may be caused by unusually heavy or prolonged rainfall, tsunami, storm surge, and high tides. In October 1972, San Pedro Creek overflowed, causing an estimated 40 acre-feet of ponding, with depths of up to 4 feet in the Linda Mar area of Pacifica (Reference 8). This storm had an estimated recurrence interval of 15 years. The Linda Mar sump area is a residential area extending northward from the vicinity of Linda Mar Boulevard, and is adjacent to State Highway 1. Flooding along Pacifica's coast is typically associated with the simultaneous occurrence of very high tides, large waves, and storm swells during the winter. As a result, oceanfront development has not been compatible with the natural instability of the shoreline and the intense winter weather conditions. Tsunami (sea waves generated from oceanic earthquakes, submarine landslides, and volcanic eruptions) create some of the most destructive natural water waves. As tsunami waves approach shallow coastal waters, wave refraction, shoaling, and bay resonance amplify the wave heights. Storm centers from the southwest produce the type of storm pattern most commonly responsible for the majority of the serious coastal flooding. The strong winds and high tides that create storm surges are also accompanied by heavy rains. In some instances, high tides back up riverflows, which causes flooding at the river mouths. The most severe storms to hit the California coast occurred in 1978 and 1983, when high-water levels were accompanied by very large storm waves. In January 1978, a series of storms emanated from a more southerly direction

Flooding Source	Description of Flood Problems
Sources within the City of Pacifica, continued	than normally occurs; consequently, some of the better-protected beaches were also damaged. Storm incidents occurred throughout the study area. Jetties and breakwater barriers were overtopped and in some cases undermined. Direct wave damage occurred to many beachfront homes, especially in the more populated beachfront areas. Accelerated erosion coupled with saturated ground conditions and rain weakened the foundations of homes on the top of beach bluffs in Pacifica. Seawalls and temporary barriers failed to protect beachfront properties from the ravages of the 1978 storms. The winter of 1983 brought a very unusual series of high tides, storm surges, and storm waves (Reference 4).
Sources within the Town of Portola	Corte Madera Creek drainage through the central portion of Portola Valley presents the greatest potential for flooding of residences. In addition, Sausal Creek drainage includes on small portion, west of Portola Road and north of Westridge Drive, which is subject to inundation because the stormdrains and culverts do not have an adequate capacity.
Sources within the City of Redwood City	The history of flooding on the streams in Redwood City indicates that flooding generally occurs during the winter or early spring. The greatest flooding occurs when a large frontal storm coincides with an extreme high tide. The major floods, since development, have occurred in February 1940, December 1955, April 1958, and January 1973. The 1955 flood was the largest recorded since 1851 with an estimated recurrence interval of 25 years, based on the flow records of San Francisquito Creek, located 4 miles south of the city. Redwood Creek overflowed its banks during the 1940, 1955, and 1958 floods, causing evacuation of some residents and inundation of and damage to many downtown businesses. The most critical overflow point is at Middlefield Road where the creek enters an underground culvert. This culvert is subject to backwater effects from high tides, thus reducing its ability to carry peak storm runoff. The overflow waters sheetflow through the central downtown area, following streets and ponding in low points. Cordilleras Creek has experienced varying degrees of flooding during storms, due mostly to debris- clogged culverts. The most severe problem along Cordilleras Creek is the limited capacity of El Camino Real and railroad culverts. Water overflowing at these culverts is diverted behind the railroad embankment into the adjacent areas of San Carlos and Redwood City. Flooding from Atherton Creek is limited to broad shallow street flow and local ponding. This is due to extensive flooding and resulting flow reduction that occurs upstream of the corporate limits. Much of this area of low relief just south of Bayshore Freeway and bounded by the Woodside Road and Marsh Road interchanges has experienced historic shallow flooding due to local drainage problems during storms occurring simultaneously with high tides. The bayfront area of Redwood City is subject to flooding northeast of Bayshore Freeway during extreme high tides. This occurred during January 1973, when an estimated 1-percent annual chance tide concurrent with a 5-year storm inundated the numerous trailer parks in that area up to 4 feet deep. The Redwood Shores development, located in northeastern Redwood City, is surrounded by a perimeter levee system. The crest of some levee reaches

Flooding Source	Description of Flood Problems
Sources within the City of Redwood City, continued	adjacent to areas not yet developed are at, or a few tenths of a foot lower than, the 1- percent annual chance tide elevation. This would cause the tide to overflow these reaches during the peak of the 1-percent annual chance tide. However, due to the short duration of that crest, flooding would be limited and shallow, provided that the levees themselves do not fail from the overtopping. Many other areas within Redwood City have experienced local flooding problems due to inadequate stormdrains or ponding in local depressions. These problems are common to the flat areas of the city, which lack a natural drainage slope. These areas were not studied.
Sources within the City of San Carlos	In recent years, flooding in the City of San Carlos has been reported during the general flood periods of 1955, 1958, 1962, and 1972, particularly during periods of high tides on San Francisco Bay. Old County Road in the vicinity of Pulgas Creek, and areas between Old County Road and Bayshore Freeway, adjacent to Pulgas Creek and Cordilleras Creek, are among areas inundated in past years. East of the railroad, flooding has occurred in the San Carlos business are a along El Camino Real between Pulgas Creek and Cordilleras Creek. The upper reaches of Pulgas Creek between Fay Street and the corporate limits have been inundated in past years. Other isolated areas of flooding have been reported, particularly along Brittan Creek; but it appears to have been caused by debris blockages at culvert entrances. No documented history of flooding in San Carlos has been found in the literature search, and the flooding described was based on reports from city officials and local residents. Flooding can occur in San Carlos due to the estimated 1-percent annual chance flood and 0.2-percent annual chance flood discharges. Flooding within San Carlos may be considered to be of three types. 1. Overflow of stream channels with the overflow returning to the channel at some downstream point. This occurs most generally in the southwestern part of the community, where gradients are relatively steep. 2. Overflow of stream channels with the flood waters not returning to the channel, but following unpredictable routes and constituting sheetflow moving in the direction of the bay. Such sheetflow occurs most frequently in the more highly developed residential, commercial, and industrial areas which lie somewhat lower, and have lesser gradients, than the areas subject to flooding of the first type. 3. Ponding of flood waters behind road embankments (railroad and Bayshore Freeway) where openings are inadequate for the extreme floods, and where gradients are likely to be so slight, at elevations near sea level, that flowageways cannot be provided. Except for the last of these types, overbank flooding comes about because of encroachment on the channel or, in some reaches, because of restrictions such as channel confinement or inadequate bridge openings. Along Cordilleras Creek from Bayshore Freeway to Industrial Road, inundation of adjacent areas will be caused by ponding of flood waters to the southwest of Bayshore Freeway. The ponding in turn is caused both by overflows from Cordilleras and Pulgas Creeks and the limited capacity of the Bayshore Freeway culverts during periods of high tides in San Francisco Bay. Southwest of Industrial Road, to the area where the creek leaves the study area, no

Flooding Source	Description of Flood Problems
Sources within the City of San Carlos, continued	flooding is expected to occur within the corporate limits. Cordilleras Creek waters passing through the railroad culvert can exceed the capacity of the adjacent Old County Road culvert , leave the channel, and flow (sheetflow) to the ponding area southwest of Bayshore Freeway. West, of the railroad, the estimated 1-percent annual chance flood discharge can exceed the capacity of the El Camino Real culvert; a major portion of the resulting floodwaters would flow northwest (sheetflow) to a ponding area southwest of the railroad. Ponding in this area is caused by overflow waters from Brittan and Pulgas Creeks and the limited flowageways through the railroad. The estimated 0.2-percent annual chance flood discharge can exceed the channel capacity of Cordilleras Creek at a point approximately 400 feet southwest of El Camino Real, with the overflow going to the same ponding area. Upstream (southwest) of this overflow point to the corporate limits, Cordilleras Creek will contain all discharges considered. The Brittan Creek channel joins Pulgas Creek immediately northeast of Old County Road near Brittan Avenue. From this confluence to the railroad, flooding is in the form of sheetflow when the 1-percent annual chance and 0.2-percent annual chance ponding elevations (southwest of the railroad) exceed the top of the railroad embankment. Southwest of the railroad, Brittan Creek parallels El Camino Real to a point near Howard Avenue where it turns southwest and crosses El Camino Real. Throughout this reach of the creek, excess waters from Pulgas, Brittan, and Cordilleras Creeks pond behind the railroad. Southwest of the ponded area to a point near Elm Street , flooding in the form of sheetflow occurs adjacent t o Brittan Creek when estimated study discharges exceed the capacity of the Elm Street culverts, with floodwaters flowing to the ponding area. No flooding will occur from Elm Street to a point approximately 700 feet northeast of Cordilleras Avenue. However, from this point to immediately southwest of Cordilleras Avenue, flooding can be expected from the estimated 0.2-percent annual chance flood discharge. From Cordilleras Avenue to a point 600 feet to the southwest, flooding can be expected from both the estimated 1-percent annual chance and 0.2-percent annual chance flood discharges. All reaches of Brittan Creek southwest of this point will contain all discharges considered. A substantial portion of the upper Brittan Creek flows are diverted near Milano Way to a recently completed stormdrain along Brittan Avenue. The drain was also designed to intercept flows from that portion of .the drainage basin lying northeast of Milano Way and northwest of Brittan Avenue (Reference 9). It is estimated that, in the vicinity of Brittan Avenue and Cedar Street, the accumulated inflows can exceed the capacity of the stormdrain; excess waters would flow overland to the ponding area near the railroad. The topography in this overflow area prevents excess waters from flowing to the Brittan Creek channel. Tidal flooding from the estimated 1-percent annual chance and 0.2-percent annual chance tides in San Francisco Bay will occur along Pulgas Creek northeast of Bayshore Freeway. To the southwest of Bayshore Freeway, the previously described ponding area extends along Pulgas Creek to a point approximately 400 feet southwest of Industrial Road. From this point t o the railroad, and then northwest to Commercial Street, flooding in the form of sheetflow can occur, the causative factors being overflow at the railroad from the ponding area to the southwest, waters passing through the railroad

Flooding Source	Description of Flood Problems
Sources within the City of San Carlos, continued	culverts overflowing the culverts parallel to and under Old County Road, and the improved Pulgas Creek channel to the east. Southwest of the railroad to the area of Laurel Street and Arroyo Avenue, flooding can occur due t o the general ponding area created by overflows from Pulgas, Brittan, and Cordilleras Creeks. Pulgas Creek is confined to stormdrains under Arroyo Avenue. The original drain extends up to Walnut Street and joins the channel to the northwest while the more recent drain (1974) extends to Elm Street and then joins the open portion of the channel. With the addition of the new drain, flooding from the study discharges is not expected to occur along that portion of the channel from Arroyo Avenue to Chestnut Street. Along Pulgas Creek, south of Chestnut Street to the area approximately 200 feet west of Cedar Street, overbank flooding in the form of sheetflow can occur. Channel constriction by the Cedar Street culvert and topography along the south bank create this condition. Flooding is not expected to occur from here to a point 350 feet east of Cordilleras Avenue. However, to the west and near Alameda de Las Pulgas, flooding in the form of sheetflow can be expected along the right bank (south side) of the creek. The flooding begins at both the Cordilleras Avenue and Alameda de Las Pulgas culverts when estimated flood discharges exceed the capacities of these culverts. Upstream (west) of this area, estimated discharges will be contained within the channel to an area approximately 150 feet downstream (northeast) of Fay Avenue. From this point to the corporate limits, on both Pulgas Creek and Devonshire Branch, the channels have been confined in conduits to facilitate residential development. The conduits cannot pass the estimated 1-percent annual chance and 0.2-percent annual chance flood discharges, and flooding of adjacent residential properties will occur. No flooding is expected along that reach of the Harbor Industrial District Channel east of Bayshore Freeway. North of Holly Street and west of Bayshore Freeway ponding will occur as a result of the inability of the Harbor Industrial District Channel culvert under Bayshore Freeway to pass the larger floodflows.
Sources within the City of San Mateo	The past history of flooding on San Mateo Creek indicates that flooding generally occurs during the winter or early spring. Major floods occurred in February 1940, December 1955, April '1958, and January 1973. The 1955 flood was the largest recorded for the periods 1930 to1941 and 1950 to 1991 based on the flow records of San Francisquito Creek, located 5 miles south of the City of San Mateo (Reference 7). Hydraulic analyses indicate that during a 1-percent annual chance flood event, San Mateo Creek will overflow its channel in the vicinity of El Camino Real and that this spill would flow through yards and streets, resulting in shallow flooding with average depths of less than 1 foot. This flooding would collect behind the San Mateo levees before being pumped back into the bay. The analyses also indicate that San Mateo Creek will overflow its channel in the vicinity of Highway 101, resulting in flooding of the area lying east of the freeway.
Sources within the City of South San Francisco	Rainfall is the principal cause of flooding in South San Francisco, The most significant flooding occurred on October 11, 1972, and January 16 and 18, 1973. The 1972 flood inundated an area of approximately 230 acres and resulted in $3,083,000 in damages (Reference 10). The floods of 1973 inundated an area

Flooding Source	Description of Flood Problems
Sources within the City of South San Francisco, continued	of approximately 180 acres and caused $1,176,000 in damages (Reference 10). The discharges associated with these floods were 2540 cubic feet per second (cfs), 2810 cfs, and 2460 cfs (Reference 10). These discharges correspond to an estimated recurrence interval of 10 to 20 years Flooding also occurred in 1955, 1958, and 1971. Colma Creek has historically been a source of flooding in South San Francisco. The western portion of the Colma Creek basin is composed of easily erodible marine sediments containing a high percentage of sand (Reference 11). Because of the higher stream velocities in the upper segments of Colma Creek, these sediments are transported to within 2 miles of the outlet at San Francisco Bay. It is in this area that the stream gradient diminishes, tidal flow becomes noticeable, and the heavier sand is deposited in the channel. Inadequate channel size, further reduced by sediment deposition, has resulted insignificant flood damage in the lower portion of Colma Creek. The only riverine flooding situation exists on Colma Creek between Hickey Boulevard Branch and the upstream corporate limits. Where Hickey Boulevard Branch joins Colma Creek, the channel has adequate capacity and makes an S- turn across the floodplain. This allows the channel to intercept most of the overbank flow, except where prevented by the channel levee. Approximately 1600 feet downstream from this point, a railroad culvert forces any flows in excess of 1500 cfs from the channel. These flows remain separated from the channel by levees or flashboards until they reach the vicinity of Oak Avenue and Mission Road. For a short distance (approximately 200 feet) in the vicinity of Oak Avenue and Mission Road, some of the overbank flow would re-enter the channel. However, from this point to Orange Avenue, the overbank and channel flows remain essentially separate and independent. At Orange Avenue, a large steel waterline under the bridge reduces its capacity to approximately 1700 cfs causing the channel overflow at this -point to join the separated overbank flow. The combined flow then crosses Orange Avenue, with flooding primarily on the north side of Colma Creek. Between Orange Avenue and Spruce Avenue, the overbank flow gradually returns to the channel. Total interception is prevented by the levee effect of the road along the channel bank. The channel between Spruce Avenue and Linden Avenue is not adequate for the 1-percent annual chance flood event, and because of a 3-foot-high concrete floodwall on either side of the channel, a separated flow condition exists. A short distance below Linden Avenue the main line of the railroad crosses Colma Creek. The culvert under the railroad is not adequate, and the railroad embankment traps the overflow, causing ponding over a wide area. Between the railroad embankment and the Produce Avenue Bridge, the channel overflows toward the south. This flow joins the flow over the railroad tracks forming an area of wide, shallow flooding. This flow is prevented from returning to the creek by floodways along the channel or the general topography of the area, until it reaches a point downstream of Utah Avenue. Flooding in South San Francisco is aggravated by the existing channel floodwalls and levees, which, although built to protect the floodplain area from lesser floods, would prevent the 1-percent annual chance overbank flows from re-entering the channel.

Flooding Source	Description of Flood Problems
Sources within the Town of Woodside	Ninety percent of the annual rainfall falls between November and April. Due to this seasonal concentration of rainfall, excess water causes flooding and ponding behind culverts. Drainage problems occur during heavy rainfall. In 1955, and again in 1957, some areas in Palo Alto, to the south, had to be evacuated. Many stream crossings are simply roadfill over culverts which can act as temporary dams during major runoff events. Except in those areas immediately upstream from restrictive bridges and culverts, there is little overbank flow. The only manmade feature with an appreciable effect on the passage of floodflows through Woodside is Searsville Lake, even though the lake is actually outside of and downstream from the corporate limits of the community. Searsville Lake is formed by a dam on Corte Madera Creek. During high flows, the lake level rises to flood a delta area in Woodside, south of the intersection of Mountain Home Road and Sand Hill Road. Corte Madera, Sausal, Martin, and Alambique Creeks converge in the delta area after leaving their steeper and more distinct upstream channels where they are less susceptible to overbank flooding. In low areas of Alambique Creek and Corte Madera Creek, sheetflow, or shallow, unpredictable overbank sheet flooding occurs.

Table 7 contains information about historic flood elevations in the communities within San Mateo County.

Table 7: Historic Flooding Elevations

Flooding Source	Location	Historic Peak (Feet NAVD88)	Event Date	Approximate Recurrence Interval (years)	Source of Data
Redwood Creek	San Mateo County, Unincorporated Areas	*	February 1940	*	*
All streams discharging into San Francisco Bay	All streams on the eastern side of San Mateo County overflowed their banks.	*	December 1955	25	Flow records of San Francisquito Creek and Pescadero Creek
Redwood Creek	Redwood City, City of	*	April 1958	*	*
San Francisco Bay	San Francisco Bay	*	January 1973	*	*
All sources within San Mateo County	San Mateo County, Unincorporated Areas	*	January 1982	*	*

Flooding Source	Location	Historic Peak (Feet NAVD88)	Event Date	Approximate Recurrence Interval (years)	Source of Data
All sources within San Mateo County	San Mateo County, Unincorporated Areas	*	February 1986	*	*
All sources within San Mateo County	San Mateo County, Unincorporated Areas	*	February 1995	*	*
San Francisquito Creek watershed and the Pescadero-Butano Creeks watershed	San Francisco Bay area	*	February 1998	*	*
All sources within San Mateo County	San Mateo County, Unincorporated Areas	*	December 2005	*	*
All sources within San Mateo County	San Mateo County, Unincorporated Areas	*	March 2006	*	*
All sources within San Mateo County	San Mateo County, Unincorporated Areas	*	January 2008	*	*

*Data not available

4.3 Non-Levee Flood Protection Measures

Table 8 contains information about non-levee flood protection measures within San Mateo County such as dams, jetties, and or dikes. Levees are addressed in Section 4.4 of this FIS Report.

Table 8: Non-Levee Flood Protection Measures

Flooding Source	Structure Name	Type of Measure	Location	Description of Measure
Colma Creek	N/A	Channel	N/A	Improvements made by the San Mateo County Flood Control District to accommodate a 50-year event with an adequate amount of freeboard.

Flooding Source	Structure Name	Type of Measure	Location	Description of Measure
Crystal Springs	N/A	Channel	N/A	N/A
El Portal Canal	El Portal Canal	Control Structure	Extends from San Francisco Bay to the main line of the railroad	Concrete-lined leveed channel
Harbor Industrial District Channel	Harbor Industrial District Channel	Channel	N/A	N/A
Hetch Hetchy Aqueduct	Hetch Hetchy Aqueduct	Aqueduct	N/A	N/A
Holly Street Channel	Holly Street Channel	Channel	N/A	N/A
Industrial Branch of Colma Creek	N/A	Channel	N/A	N/A
Lomita Channel	Lomita Channel	Channel	Extends from the main line of the railroad and terminates at Millbrae Canal and U.S. Highway 101	Improved earth channel that functions as a pumped storage outlet for Lornita Creek
Millbrae Canal	Millbrae Canal	Channel	Extends from San Francisco Bay to the main line of the railroad	Concrete-lined levee channel
Pacific Ocean	N/A	Seawall	Various Locations	N/A
Pacific Ocean	N/A	Revetment	Various Locations	N/A
N/A	N/A	Riprap	City of Half Moon Bay	Boulder riprap was installed along the coastal study area in 1983
San Bruno Channel	N/A	Channel	N/A	N/A
San Francisquito Creek	N/A	Berms	Located at Middlefield Road and Pope Street	Constructed to increase the available headwater for these crossings and to stabilize and increase the height of the banks along the creek

4.4 Levees

For purposes of the NFIP, FEMA only recognizes levee systems that meet, and continue to meet, minimum design, operation, and maintenance standards that are consistent with comprehensive floodplain management criteria. The Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10) describes the information needed for FEMA to determine if a levee system reduces the risk from the 1% annual chance flood. This information must be supplied to FEMA by the community or other party when a flood risk study or restudy is conducted, when FIRMs are revised, or upon FEMA request. FEMA reviews the information for the purpose of establishing the appropriate FIRM flood zone.

Levee systems that are determined to reduce the risk from the 1% annual chance flood are accredited by FEMA. FEMA can also grant provisional accreditation to a levee system that was previously accredited on an effective FIRM and for which FEMA is awaiting data and/or documentation to demonstrate compliance with Section 65.10. These levee systems are referred to as Provisionally Accredited Levees, or PALs. Provisional accreditation provides communities and levee owners with a specified timeframe to obtain the necessary data to confirm the levee's certification status. Accredited levee systems and PALs are shown on the FIRM using the symbology shown in Figure 3 and in Table 9. If the required information for a PAL is not submitted within the required timeframe, or if information indicates that a levee system not longer meets Section 65.10, FEMA will de-accredit the levee system and issue an effective FIRM showing the levee-impacted area as a SFHA.

FEMA coordinates its programs with USACE, who may inspect, maintain, and repair levee systems. The USACE has authority under Public Law 84-99 to supplement local efforts to repair flood control projects that are damaged by floods. Like FEMA, the USACE provides a program to allow public sponsors or operators to address levee system maintenance deficiencies. Failure to do so within the required timeframe results in the levee system being placed in an inactive status in the USACE Rehabilitation and Inspection Program. Levee systems in an inactive status are ineligible for rehabilitation assistance under Public Law 84-99.

FEMA coordinated with the USACE, the local communities, and other organizations to compile a list of levees that exist within San Mateo County. Table 9, "Levees," lists all accredited levees, PALs, and de-accredited levees shown on the FIRM for this FIS Report. Other categories of levees may also be included in the table. The Levee ID shown in this table may not match numbers based on other identification systems that were listed in previous FIS Reports. Levees identified as PALs in the table are labeled on the FIRM to indicate their provisional status.

Please note that the information presented in Table 9 is subject to change at any time. For that reason, the latest information regarding any USACE structure presented in the table should be obtained by contacting USACE and accessing the USACE national levee database. For levees owned and/or operated by someone other than the USACE, contact the local community shown in Table 31.

Table 9: Levees

Community	Flooding Source	Levee Location	Levee Owner	USACE Levee	Levee ID	Covered Under PL84-99 Program?	FIRM Panel(s)	Levee Status
Foster, City of	San Francisco Bay		City of Foster	No	124	No	06081C0158F 06081C0159F 06081C0167F 06081C0178E 06081C0186E	
Redwood City, City of	Belmont Slough		Nikon Ventures Corp	No	94	No	06081C0167F 06081C0169F	De-Accredited
Redwood City, City of	San Francisco Bay		City of Redwood City	No	130	No	06081C0186E	
Redwood City, City of	San Francisco Bay		City of Redwood City	No	131	No	06081C0186E	
Redwood City, City of	San Francisco Bay		City of Redwood City	No	132	No	06081C0186E	
Redwood City, City of	San Francisco Bay		City of Redwood City	No	133	No	06081C0167F 06081C0186E	
Redwood City, City of	Steinberger Slough		City of Redwood City	No	121	No	06081C0186E 06081C0188E	
Redwood City, City of ; San Carlos, City of	Steinberger Slough		San Mateo County	No	13	No	06081C0188E	

Community	Flooding Source	Levee Location	Levee Owner	USACE Levee	Levee ID	Covered Under PL84-99 Program?	FIRM Panel(s)	Levee Status
San Carlos, City of	Pulgas Creek		City of San Carlos	No	134	No	06081C0188E	
San Carlos, City of	Steinberger Slough		City of San Carlos	No		No	06081C0188E	
San Mateo, City of	O'Neill Slough		City of San Mateo	No			06081C0167F	
San Mateo, City of	O'Neill Slough		City of San Mateo	No			06081C0167F	
San Mateo, City of	San Mateo Creek		City of San Mateo	No	34	No	06081C0158F	Accredited
San Mateo, City of	San Mateo Creek		City of San Mateo	No	49	No	06081C0158F	De-Accredited
San Mateo, City of	San Mateo Creek		City of San Mateo	No	80	No	06081C0158F	Accredited
San Mateo, City of	San Mateo Creek		City of San Mateo	No	86	No	06081C0158F	De-Accredited
San Mateo, City of	Marina Lagoon		City of San Mateo	No	84	No	06081C0158F	
San Mateo, City of	San Francisco Bay		City of San Mateo	No	4	No	06081C0167F	
San Mateo, City of	San Francisco Bay		City of San Mateo	No	69	No	06081C0158F	
San Mateo, City of	San Mateo Creek		City of San Mateo	No	122	No	06081C0158F	Accredited

Community	Flooding Source	Levee Location	Levee Owner	USACE Levee	Levee ID	Covered Under PL84-99 Program?	FIRM Panel(s)	Levee Status
San Mateo, City of	San Francisco Bay		City of San Mateo	No	97	No	06081C0158F	De-Accredited

SECTION 5.0 – ENGINEERING METHODS

For the flooding sources in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded at least once on the average during any 10-, 25-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 25-, 50-, 100-, and 500-year floods, have a 10-, 4-, 2-, 1-, and 0.2% annual chance, respectively, of being equaled or exceeded during any year.

Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedance) during the term of a 30-year mortgage is approximately 26 percent (about 3 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

The engineering analyses described here incorporate the results of previously issued Letters of Map Change (LOMCs) listed in Table 27, “Incorporated Letters of Map Change”, which include Letters of Map Revision (LOMRs). For more information about LOMRs, refer to Section 6.5, “FIRM Revisions.”

5.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak elevation-frequency relationships for floods of the selected recurrence intervals for each flooding source studied. Hydrologic analyses are typically performed at the watershed level. Depending on factors such as watershed size and shape, land use and urbanization, and natural or man-made storage, various models or methodologies may be applied. A summary of the hydrologic methods applied to develop the discharges used in the hydraulic analyses for each stream is provided in Table 13. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

A summary of the discharges is provided in Table 10. Frequency Discharge-Drainage Area Curves used to develop the hydrologic models may also be shown in Figure 7 for selected flooding sources. A summary of stillwater elevations developed for non-coastal flooding sources is provided in Table 11. (Coastal stillwater elevations are discussed in Section 5.3 and shown in Table 17.) Stream gage information is provided in Table 12.

Table 10: Summary of Discharges

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)					
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance Existing	1% Annual Chance Future	0.2% Annual Chance
16th Avenue Drainage Channel	At Highway 101	--[4]	--[4]	*	--[4]	800	*	--[4]
16th Avenue Drainage Channel	At Southern Pacific Railroad Crossing	--[4]	--[4]	*	--[4]	490	*	--[4]
19th Avenue Drainage Channel	At Highway 101	--[4]	--[4]	*	--[4]	1,500	*	--[4]
19th Avenue Drainage Channel	At Bermuda Drive	--[4]	--[4]	*	--[4]	1,450	*	--[4]
19th Avenue Drainage Channel	At Delaware Street	--[4]	--[4]	*	--[4]	1,330	*	--[4]
19th Avenue Drainage Channel	At South Pacific Railroad Crossing	--[4]	--[4]	*	--[4]	1,310	*	--[4]
Atherton Creek	At Railroad	5.0	350[1]	*	350[1]	350[1,2]	*	350[3]

*Not calculated for this Flood Risk Project

[1]Capacity of Atherton Creek box culvert

[2]1,750 cubic feet per second spilled upstream of study area during the 1-percent annual chance flood event

[3]170 cubic feet per second spilled to Redwood City during the 1-percent annual chance flood event

[4]Data not available

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs) 10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance Existing	1% Annual Chance Future	0.2% Annual Chance
Belmont Creek	At U.S. Highway 101	2.8	660	*	1,200	1,400	*	1,600
Belmont Creek	At El Camino Real	2.5	570	*	1,000	1,200	*	1,400
Colma Creek	At San Francisco Bay	16.0	2,900	*	5,100	5,800	*	7,000
Colma Creek	Below Spruce Branch	12.7	2,500	*	4,400	5,000	*	6,100
Colma Creek	At U.S. Geological Survey Gage in Orange Park	10.9	2,400	*	4,100	4,700	*	5,700
Colma Creek	Below Hickey Boulevard Tributary	6.0	1,700	*	2,900	3,400	*	4,100
Colma Creek	At F Street	1.7	800	*	1,200	1,400	*	1,600
Cordilleras Creek	At Bayshore Freeway	3.6	525	*	700[1]	850[1]	*	1,490[1]
Cordilleras Creek	At Old County Road	3.3	470	*	620[2]	680[1,2]	*	1,190[2]
Cordilleras Creek	At El Camino Real	3.3	470	*	940	1,170	*	1,800
Cordilleras Creek	At Stanford Lane	3.1	460	*	900	1,120	*	1,700

*Not calculated for this Flood Risk Project

[1]170 cubic feet per second spilled to Redwood City during the 1-percent annual chance flood event

[2]Flows reduced due to overflow into San Carlos and Redwood City

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)					
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance Existing	1% Annual Chance Future	0.2% Annual Chance
Cordilleras Creek	At Alameda de las Pulgas	2.6	400	*	730	890	*	1,300
Denniston Creek	At Half Moon Bay	4.0	800	*	1,400	1,600	*	2,100
Denniston Creek	Near Sheltercove Drive	3.8	780	*	1,300	1,600	*	2,000
Denniston Creek	At Reservoir	3.2	700	*	1,200	1,400	*	1,800
Easton Creek	At Railroad	0.79	260	*	410	470	*	540
El Granada Creek	At Half Moon Bay	0.6	190	*	300	340	*	440
El Granada Creek	At Reservoir	0.5	160	*	250	290	*	370
Holly Street Channel	At U.S. Highway 101	0.40	240	*	370[2]	420[2]	*	420[2]
Industrial Branch	At Colma Creek	1.5	490	*	720	800	*	970
La Honda Creek	At confluence with San Gregorio Creek	11.8	2,100	*	3,500	4,200	*	5,500
La Honda Creek	Downstream of confluence with Woodhams Creek	10.9	1,900	*	3,300	3,800	*	5,200

*Not calculated for this Flood Risk Project

[1]Flows reduced due to upstream spill

[2]Values do not include overland flow from Belmont Creek

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)					
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance Existing	1% Annual Chance Future	0.2% Annual Chance
La Honda Creek	Upstream of confluence with Woodhams Creek	10.0	1,800	*	3,100	3,600	*	4,800
Laurel Creek	At Highway 101	--[1]	--[1]	*	--[1]	1,950	*	--[1]
Laurel Creek	At George Hall School	--[1]	--[1]	*	--[1]	1,420	*	--[1]
Laurel Creek	At Otay	--[1]	--[1]	*	--[1]	1,130	*	--[1]
Laurel Creek	At Alameda de las Pulgas	--[1]	--[1]	*	--[1]	970	*	--[1]
Lomita Channel	At railroad[2]							
Mills Creek	At railroad	0.52	190	*	290	330	*	370
Mills Creek & Easton Creek	At U.S. Highway 101[3]	2.46	750	*	840	840	*	840
Montara Creek	At Pacific Ocean	1.70	380	*	640	760	*	1,000
Montara Creek	At Harte Street	1.30	310	*	530	620	*	830
Montara Creek	At Riviera Street	0.80	220	*	360	420	*	560
Navigable Slough	At Colma Creek	0.4	200	*	270	300	*	300
Pescadero Creek	At Pacific Ocean	81.3	11,000	*	20,000	24,000	*	29,000

*Not calculated for this Flood Risk Project

[1]Data not available

[2]Inflow to low area west of track, 1-percent annual chance outflow is 170 cubic feet per second

[3]Flows limited by culvert capacity, ponding and pump capacity

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)					
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance Existing	1% Annual Chance Future	0.2% Annual Chance
Pescadero Creek	At Pescadero Road east of town	53.3	7,700	*	13,900	16,700	*	20,000
Ralston Creek & Burlingame Creek	At railroad	1.65	500	*	800	930	*	1,100
Redwood Creek	At Bayshore Freeway	9.3	1,900	*	3,300	4,000	*	5,000
Redwood Creek	At Broadway	8.8	1,800	*	3,200	3,800	*	4,800
Redwood Creek	At El Camino Real	5.2	1,200	*	2,100	2,500	*	3,200
Sanchez Creek	At railroad	1.65	500	*	800	930	*	1,100
Sanchez Creek, Ralston Creek & Burlingame Creek	At U.S. Highway 101[1]	4.65	1,100	*	1,600	1,600	*	1,600
San Francisquito Creek	At U.S. Highway 101	41.7	4,400	*	6,020[2]	6,060[2]	*	6,300[2]
San Francisquito Creek	Downstream of Pope Street	41.6	--[3]	*	--[3]	6,250	*	--[3]

*Not calculated for this Flood Risk Project

[1]Flows limited by culvert capacity, ponding and pump capacity

[2]Flows reduced due to upstream spill

[3]Data not available

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)					
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance Existing	1% Annual Chance Future	0.2% Annual Chance
San Francisquito Creek	Downstream of Middlefield Road	41.6	--[1]	*	--[1]	6,965	*	--[1]
San Francisquito Creek	Upstream of Middlefield Road	41.6	4,350	*	7,100	8,330	*	--[1]
San Francisquito Creek	At El Camino Real	40.6	4,350	*	7,050	8,280	*	9,850[2]
San Francisquito Creek Overflow	North of U.S. Highway 101	--[1]	--[1]	*	--[1]	570	*	--[1]
San Francisquito Creek Overflow	South of U.S. Highway 101	--[1]	--[1]	*	--[1]	1,154	*	--[1]
San Francisquito Creek Overflow	Combined Middlefield Road and Pope Street Overflows	--[1]	--[1]	*	--[1]	1,154	*	--[1]
San Francisquito Creek Overflow	At Pope Street	--[1]	--[1]	*	--[1]	730	*	--[1]
San Francisquito Creek Overflow	At Middlefield Road	--[1]	--[1]	*	--[1]	640	*	--[1]

*Not calculated for this Flood Risk Project

[1]Data not available

[2]Value reflects spills from the channel into Palo Alto

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)					
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance Existing	1% Annual Chance Future	0.2% Annual Chance
San Gregorio Creek	At downstream Limit of Study	22.4	3,500	*	6,100	7,200	*	9,700
San Gregorio Creek	Downstream of State Highway 84	21.8	3,400	*	6,000	7,100	*	9,400
San Gregorio Creek	Downstream of confluence with La Honda Creek	21.3	3,300	*	4,800	6,900	*	9,300
San Gregorio Creek	Upstream of confluence with La Honda Creek	9.5	1,800	*	3,000	3,600	*	4,600
San Gregorio Creek	At upstream Limit of Study	9.3	1,800	*	3,000	3,500	*	4,500
San Mateo Creek	Approximately 400 feet downstream of Crystal Springs Road	33.3	--[1]	*	--[1]	2,124	*	--[1]
San Mateo Creek	At downstream side of South Humboldt Street & East Third Avenue	--[1]	--[1]	*	--[1]	1,493[2]	*	--[1]
San Mateo Creek	At mouth (City of San Mateo)	--[1]	--[1]	*	--[1]	1,017[2]	*	--[1]

*Not calculated for this Flood Risk Project

[1]Data not available

[2]Flows reduced due to upstream spill

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)					
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance Existing	1% Annual Chance Future	0.2% Annual Chance
San Vicente Creek	At Pacific Ocean	1.9	430	*	720	840	*	1,100
San Vicente Creek	At Etheldore Street	1.7	400	*	670	780	*	1,000
San Vicente Creek	At upper Study Limit	1.4	340	*	570	660	*	880
Spruce Branch	At Colma Creek	1.5	540	*	770	810	*	830
Woodhams Creek	At confluence with La Honda Creek	0.9	270	*	520	480	*	600
Woodhams Creek	At Esmeralda Terrace	0.7	220	*	340	390	*	480

*Not calculated for this Flood Risk Project

Figure 7: Frequency Discharge-Drainage Area Curves

[Not applicable to this Flood Risk Project]

Table 11: Summary of Non-Coastal Stillwater Elevations

Flooding Source	Location	Elevations (feet NAVD88)				
		10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
San Francisco Bay	At South San Francisco	8.9	*	9.2	9.3	9.6
San Francisco Bay	At Millbrae	9.0	*	9.5	9.6	9.9
San Francisco Bay	At Burlingame	9.2	*	9.6	9.7	10.0
San Francisco Bay	At Redwood Shores	9.3	*	9.6	9.7	10.0
San Francisco Bay	At Redwood Creek	9.0	*	9.4	9.5	9.8
San Francisco Bay	At Marsh Road/Bayshore Freeway Interchange (East Redwood City)	9.5[3]	*	9.7[3]	10.2[2]	10.2[3]
San Francisco Bay	At Willow Road	--[1]	*	--[1]	10.3	--[1]
San Francisco Bay	10,030 feet south of Dumbarton Bridge	--[1]	*	--[1]	10.4	--[1]
San Francisco Bay	At San Francisquito Creek	9.8[2]	*	10.0[2]	10.4[4]	10.5[2]

*Not calculated for this Flood Risk Project

[1]Data not available

[2]Taken from City of Menlo park FIS revised April 21, 1999 (Reference 58)

[3]Taken from San Mateo (Unincorporated Areas) FIS dated August 5, 1986 (Reference 59)

[4]Taken from East Palo Alto FIS revised August 23, 1999 (Reference 60)

		Elevations (feet NAVD88)				
Flooding Source	Location	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Central Lagoon [1,2]	Entire lagoon	--[3]	*	--[3]	1.9	--[3]
Marina Lagoon[1,4]	Entire lagoon	--[3]	*	--[3]	2.5	--[3]
Redwood Shores Lagoon[1,5]	Entire lagoon	--[3]	*	--[3]	2.8	--[3]

*Not calculated for this Flood Risk Project

[1]1% Annual Chance Flood Discharge Contained in Lagoon notes have been added to the FIRM panels

[2]Elevation is rounded to 2 feet on FIRM panels

[3]Data not available

[4]Elevation is rounded to 3 feet on FIRM panels

[5]Mapped as Zone A on FIRM panels

Table 12: Stream Gage Information used to Determine Discharges

Flooding Source	Gage Identifier	Agency that Maintains Gage	Site Name	Drainage Area (Square Miles)	Period of Record	
					From	To
San Francisquito Creek	11-1645	USGS	Approximately 2 miles upstream of El Camino Real	N/A	1930	1941
San Francisquito Creek	11-1645	USGS	Approximately 2 miles upstream of El Camino Real	N/A	1951	1978
Redwood Creek	11-1628	USGS	Upper reach of Redwood Creek west of the corporate limits	N/A	1960	Present
Colma Creek	N/A	USGS	Located in Orange Park	N/A	1964	Present
Pescadero Creek	11-1625	USGS	2 to 4 miles upstream of study area	N/A	N/A	N/A
Butano Creek	11-1625.4	USGS	2 to 4 miles upstream of study area	N/A	N/A	N/A
San Gregorio Creek	11-1625.7	USGS	Located 4 miles below the La Honda study site	N/A	N/A	N/A

5.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Base flood elevations on the FIRM represent the elevations shown on the Flood Profiles and in the Floodway Data tables in the FIS Report. Rounded whole-foot elevations may be shown on the FIRM in coastal areas, areas of ponding, and other areas with static base flood elevations. These whole-foot elevations may not exactly reflect the elevations derived from the hydraulic analyses. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS Report in conjunction with the data shown on the FIRM. The hydraulic analyses for this FIS were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

For streams for which hydraulic analyses were based on cross sections, locations of selected cross sections are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 6.3), selected cross sections are also listed on Table 24, "Floodway Data."

A summary of the methods used in hydraulic analyses performed for this project is provided in Table 13. Roughness coefficients are provided in Table 14. Roughness coefficients are values representing the frictional resistance water experiences when passing overland or through a channel. They are used in the calculations to determine water surface elevations. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

Table 13: Summary of Hydrologic and Hydraulic Analyses

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Alpine Creek	Confluence with La Honda Creek	Approximately 3,180 feet upstream of Pescadero Road	Regional Regression Analysis	USACE HEC-2	*	A	*
Ano Nuevo Creek	At Cabrillo Highway	Approximately 1,800 feet upstream of Cabrillo Highway	Regional Regression Analysis	USACE HEC-2	*	A	*
Apanolio Creek	Confluence with Pilarcitos Creek	Approximately 1.7 miles upstream of San Mateo Road	Regional Regression Analysis	USACE HEC-2	*	A	*
Arroyo de los Frijoles	Approximately 4,200 feet upstream of Bean Hollow Road	Approximately 2.7 miles upstream of Bean Hollow Road	Regional Regression Analysis	USACE HEC-2	*	A	*
Arroyo Leon	Confluence with Pilarcitos Creek	Approximately 1,012 feet upstream of confluence of Mills Creek	Regional Regression Analysis	USACE HEC-2	*	A	*
Atherton Creek	Approximately 345 feet downstream of US Highway 101	Approximately 103 feet upstream of Bayshore Freeway	Regional Regression Analysis	USACE HEC-2	*	A	Starting water-surface elevations were based on the slope-area method.
Bean Hollow Lakes	Approximately 3.1 miles upstream of Bean Hollow Road	Approximately 4.2 miles upstream of Bean Hollow Road	Regional Regression Analysis	USACE HEC-2	*	A	*
Bear Gulch Creek	Confluence with San Francisquito Creek	At Sand Hill Road	Regional Regression Analysis	USACE HEC-2	*	A	*

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Belmont Creek	At Bayshore Freeway	Approximately 3,240 feet upstream of Carlmont Drive	Regional Regression Analysis	USACE HEC-2	*	A	*
Belmont Slough	Confluence with San Francisco Bay	Approximately 400 feet downstream of Shoreway Road	Regional Regression Analysis	USACE HEC-2	*	AE	*
Bogess Creek	Confluence with San Gregorio Creek	Approximately 2,400 feet upstream of La Honda Road	Regional Regression Analysis	USACE HEC-2	*	A	*
Bradley Creek	Approximately 1,550 feet upstream of confluence with Pescadero Creek	Approximately 1,630 feet upstream of confluence of Tahana Gulch	Regional Regression Analysis	USACE HEC-2	*	A	*
Brittan Creek	Confluence with Pulgas Creek	Approximately 700 feet upstream of Graceland Avenue	Log-Pearson Type III	Computer Program A526, Culvert Analysis; Computer Program C649, Backwater Analysis	*	A	*
Burlingame Channel	At Mission Street	Approximately 800 feet upstream of Occidental Avenue	Regional Regression Analysis	Direct Step-Backwater Computer Program	*	A	*
Burlingame Lagoon	Confluence with San Francisco Bay	At Broadway Extension / Airport Boulevard	Regional Regression Analysis	Direct Step-Backwater Computer Program	*	AE	The starting water-surface elevation was the mean higher high water level of 3.5 feet as determined for the tides in San Francisco Bay (Reference 36).

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Butano Creek	Confluence with Pacific Ocean	Approximately 1,184 feet upstream of Pescadero Creek Road	Regional Regression Analysis	USACE HEC-2	*	AE	*
Butano Creek	Approximately 1,184 feet upstream of Pescadero Creek Road	Approximately 3 miles upstream of confluence of Little Butano Creek	Regional Regression Analysis	USACE HEC-2	*	A	*
Calera Creek	Confluence with Pacific Ocean	Approximately 760 feet upstream of Modoc Place	Regional Regression Analysis	USACE HEC-2	*	A	*
Cascade Creek	Confluence with Pacific Ocean	Approximately 4,236 feet upstream of Cabrillo Highway	Regional Regression Analysis	USACE HEC-2	*	A	*
Central Lake	Confluence with San Francisco Bay	Approximately 1.5 miles upstream of Beach Park Boulevard	Regional Regression Analysis	USACE HEC-2	*	A	*
Chandler Gulch	Confluence with Bradley Creek	Approximately 1,660 feet upstream of Stage Road	Regional Regression Analysis	USACE HEC-2	*	A	*
Clear Creek	Confluence with San Gregorio Creek	Approximately 4,640 feet upstream of La Honda Road	Regional Regression Analysis	USACE HEC-2	*	A	*

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Colma Creek	Approximately 0.25 mile upstream of Lawndale Boulevard	Approximately 0.48 mile upstream of Lawndale Boulevard	Regional Regression Analysis	USACE HEC-2	*	AE	A U.S. Geological Survey stream gaging station located on Colma Creek in Orange Park has operated since 1964 (Reference 13). Although a frequency analysis was made of the flood peak record, the results were not directly applied due to the shortness of record and the rapidly changing basin hydrologic response brought about by urbanization. The regional relationships developed at other gaging stations were transferred to the Colma Creek basin by means of the statistically derived regression equations. The significant basin characteristics relating to flood peaks were drainage area and mean annual precipitation (Reference 15).
Colma Creek	Approximately 1,470 feet upstream of Lawndale Boulevard	Approximately 2,690 feet upstream of Lawndale Boulevard	Regional Regression Analysis	USACE HEC-2	*	AE	A U.S. Geological Survey stream gaging station located on Colma Creek in Orange Park has operated since 1964 (Reference 13). Although a frequency analysis was made of the flood peak record, the results were not directly applied due to the shortness of record and the rapidly changing basin hydrologic response brought about by urbanization. The regional relationships developed at other gaging stations were transferred to the Colma Creek basin by means of the statistically derived regression equations. The significant basin characteristics relating to flood peaks were drainage area and mean annual precipitation (Reference 15).

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Colma Creek	Confluence with San Bruno Canal	Approximately 1,470 feet upstream of Lawndale Boulevard	Regional Regression Analysis	USACE HEC-2	*	A	A U.S. Geological Survey stream gaging station located on Colma Creek in Orange Park has operated since 1964 (Reference 13). Although a frequency analysis was made of the flood peak record, the results were not directly applied due to the shortness of record and the rapidly changing basin hydrologic response brought about by urbanization. The regional relationships developed at other gaging stations were transferred to the Colma Creek basin by means of the statistically derived regression equations. The significant basin characteristics relating to flood peaks were drainage area and mean annual precipitation (Reference 15).
Cordilleras Creek	Confluence with Steinberger Slough	Approximately 830 feet upstream of Scenic drive	Regional Regression Analysis	USACE HEC-2	*	AE	Starting water-surface elevations were calculated using the Mean Higher High Water elevation of 4.0 feet for the tides in San Francisco Bay.
Cordilleras Creek	Approximately 740 feet downstream of Scenic Drive	Approximately 830 feet upstream of Scenic Drive	Regional Regression Analysis	USACE HEC-2	*	A	Starting water-surface elevations were calculated using the Mean Higher High Water elevation of 4.0 feet for the tides in San Francisco Bay.
Corinda Los Trancos Creek	Confluence with Pilarcitos Creek	Approximately 3,480 feet upstream of San Mateo Road	Regional Regression Analysis	USACE HEC-2	*	A	*
Corte Madera Creek	Approximately 1 mile downstream of Westridge Drive	Approximately 0.75 mile upstream of Willowbrook Drive	NRCS Design Hydrograph Method	Rainfall-Runoff, Topographic Features, and Normal Depth Calculations	*	AE, A	The portion of Corte Madera Creek upstream from Alpine Road and the unnamed tributary to Corte Madera Creek were not studied in detail because of the lack of current or planned development along those streams. The 1-percent annual chance flood for those streams was approximated based on regional rainfall-runoff estimates, topographic features, and normal depth calculations.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Corte Madera Creek	Approximately 0.75 mile upstream of Willowbrook Drive	Approximately 1.28 miles upstream of Willowbrook Drive	NRCS Design Hydrograph Method	Rainfall-Runoff, Topographic Features, and Normal Depth Calculations	*	A	The portion of Corte Madera Creek upstream from Alpine Road and the unnamed tributary to Corte Madera Creek were not studied in detail because of the lack of current or planned development along those streams. The 1-percent annual chance flood for those streams was approximated based on regional rainfall-runoff estimates, topographic features, and normal depth calculations.
Coyote Creek	Confluence with San Gregorio Creek	Approximately 1,030 feet upstream of confluence with San Gregorio Creek	Regional Regression Analysis	USACE HEC-2	*	A	*
Denniston Creek	At mouth of Denniston Creek	Approximately 0.3 mile upstream of Farm Bridge	Regional Regression Analysis	USACE HEC-2	*	VE, AE	*
Denniston Creek	Approximately 0.75 mile upstream of State Highway 1	Approximately 2.45 miles upstream of State Highway 1	Regional Regression Analysis	USACE HEC-2	*	A	*
Devonshire of Pulgas Creek	Confluence with Pulgas Creek	Approximately 720 feet upstream of confluence with Pulgas Creek	Log-Pearson Type III	Computer Program A526, Culvert Analysis; Computer Program C649, Backwater Analysis	*	AE	*
Easton Creek	Confluence with San Francisco Bay	Approximately 367 feet upstream of Bayshore Highway	Regional Regression Analysis	Direct Step-Backwater Computer Program	*	AE	*

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Easton Creek	Approximately 367 feet upstream of Bayshore Highway	Approximately 160 feet upstream of Bernal Avenue	Regional Regression Analysis	Direct Step-Backwater Computer Program	*	A	*
El Corte de Madera Creek	Confluence with San Gregorio Creek	Approximately 1,877 feet upstream of Bear Gulch Road	Regional Regression Analysis	USACE HEC-2	*	A	*
El Granada Creek	At mouth of El Granada Creek	Approximately 750feet upstream of San Juan Avenue	Regional Regression Analysis	USACE HEC-2	*	AE	*
El Portal Canal	At Bayshore Freeway	At Union Pacific Railroad	Regional Regression Analysis	Direct Step-Backwater Computer Program	*	A	The starting water-surface elevation was the mean higher high water level of 3.5 feet as determined for the tides in San Francisco Bay (Reference 36).
Elliot Creek	Confluence with Pacific Ocean	Approximately 950 feet upstream of Cabrillo Highway	Regional Regression Analysis	USACE HEC-2	*	A	*
Finney Creek	Confluence with Pacific Ocean	Approximately 1,300 feet upstream of Cabrillo Highway	Regional Regression Analysis	USACE HEC-2	*	A	*
Frenchmans Creek	Approximately 1,200 feet downstream of Cabrillo Highway North	Approximately 1.6 miles upstream of Cabrillo Highway North	Regional Regression Analysis	USACE HEC-2	*	A	*
Gazos Creek	Confluence with Pacific Ocean	Approximately 2,957 feet upstream of Cabrillo Highway	Regional Regression Analysis	USACE HEC-2	*	VE, A	*

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Green Hills Creek	Approximately 95 feet upstream of Helen Drive	Approximately 288 feet upstream of Helen Drive	Regional Regression Analysis	USACE HEC-2	*	A	*
Green Oaks Creek	Confluence with Pacific Ocean	Approximately 3,980 feet upstream of Cabrillo Highway	Regional Regression Analysis	USACE HEC-2	*	VE, A	*
Hamms Gulch	Confluence with Corte Madera Creek	Approximately 460 feet upstream of confluence with Corte Madera Creek	NRCS Design Hydrograph Method	Portland WSP Computer Program	*	A	*
Harbor Industrial District Channel	Confluence with Steinberger Slough	Approximately 630 feet upstream of Fairfield Drive	Regional Regression Analysis	USACE HEC-2	*	AE, A	*
Harrington Creek	Confluence with San Gregorio Creek	Approximately 1,000 feet upstream of confluence with San Gregorio Creek	Regional Regression Analysis	USACE HEC-2	*	A	*
Honsinger Creek	Approximately 680 feet upstream of confluence with Pescadero Creek	Approximately 3,090 feet upstream of Pescadero Creek Road	Regional Regression Analysis	USACE HEC-2	*	A	*
La Honda Creek	Confluence with San Gregorio Creek	Approximately 870 feet upstream of confluence with Woodhams Creek	Regional Regression Analysis	USACE HEC-2	*	AE	*
Lake Lucerna	At Bean Hollow Road	Approximately 4,370 feet upstream of Bean Hollow Road	Regional Regression Analysis	USACE HEC-2	*	A	*

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Laurel Creek	Approximately 275 feet downstream of State Highway 1	Approximately 0.3 mile upstream of Laurel Street	Regional Regression Analysis	USACE HEC-2	*	AE	*
Little Butano Creek	Confluence with Butano Creek	Approximately 450 feet upstream of Cloverdale Road	Regional Regression Analysis	USACE HEC-2	*	A	*
Lomita Channel	At Bayshore Freeway	At Union Pacific Railroad	Regional Regression Analysis	USACE HEC-2	*	A	Starting water-surface elevation was obtained by using the ponding elevation (4 feet) of the shallow flooding area adjacent to the lower portion of the canal.
Los Trancos Creek	Approximately 1.3 miles downstream of Arastradero Road	Approximately 623 feet upstream of Los Trancos Road	NRCS Design Hydrograph Method	Rainfall-Runoff, Topographic Features, and Normal Depth Calculations	*	A	The portion of Corte Madera Creek upstream from Alpine Road and the unnamed tributary to Corte Madera Creek were not studied in detail because of the lack of current or planned development along those streams. The 1-percent annual chance flood for those streams was approximated based on regional rainfall-runoff estimates, topographic features, and normal depth calculations.
Madonna Creek	Confluence with Pilarcitos Creek	Approximately 564 feet upstream of Pilarcitos Creek	Regional Regression Analysis	USACE HEC-2	*	A	*
McCormick Creek	Confluence with Pescadero Creek	Approximately 2,520 feet upstream of Pescadero Road	Regional Regression Analysis	USACE HEC-2	*	A	*
Middle Fork San Pedro Creek	Confluence with San Pedro Creek	Approximately 3,860 feet upstream of Oddstad Boulevard	Regional Regression Analysis	USACE HEC-2	*	A	*
Milagra Creek	Confluence with Pacific Ocean	Approximately 1,066 feet upstream of Edgemar Avenue	Regional Regression Analysis	USACE HEC-2	*	A	*

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Millbrae (High Line) Canal	Approximately 930 feet downstream of South Ashton Avenue	Approximately 230 feet upstream of South Ashton Avenue	Regional Regression Analysis	USACE HEC-2	*	A	Starting water-surface elevations were calculated using the mean higher high water of 3.5 feet for the tides in San Francisco Bay.
Mills Creek	Confluence with Arroyo Leon	Approximately 1.5 miles upstream of confluence with Arroyo Leon	Regional Regression Analysis	USACE HEC-2	*	A	*
Montara Creek	Approximately 460 feet downstream of State Highway 1	Approximately 1,080 feet upstream of Drake Street	Regional Regression Analysis	USACE HEC-2	*	AE	*
O'Neil Slough	Confluence with Belmont Slough	Confluence of Marina Lagoon	Regional Regression Analysis	USACE HEC-2	*	AE, A	*
Palmer Gulch	Confluence with San Gregorio Creek	Approximately 1,250 feet upstream of La Honda Road	Regional Regression Analysis	USACE HEC-2	*	A	*
Pescadero Creek	Approximately 107 feet downstream of State Highway 1	Approximately 1,790 feet upstream of Butano Cut Off Road	Regional Regression Analysis	USACE HEC-2	*	AE	*
Pescadero Creek	Approximately 1,790 feet upstream of Butano Cut Off Road	Approximately 4 miles upstream of confluence of McCormick Creek	Regional Regression Analysis	USACE HEC-2	*	A	*
Pilarcitos Creek	Confluence of Arroyo Leon	Approximately 524 feet upstream of Pilarcitos Creek Road	Regional Regression Analysis	USACE HEC-2	*	A	*
Pomponio Creek	Confluence with Pacific Ocean	Approximately 4 miles upstream of Stage Road	Regional Regression Analysis	USACE HEC-2	*	VE, A	*

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Pulgas Creek	Confluence with Steinberger Slough	Approximately 179 feet downstream of Fay Avenue	Log-Pearson Type III	Computer Program A526, Culvert Analysis; Computer Program C649, Backwater Analysis	*	VE, A	*
Purisima Creek	Confluence with Pacific Ocean	Approximately 3.4 miles upstream of Verde Road	Regional Regression Analysis	USACE HEC-2	*	A	*
Redwood Creek	Confluence with San Francisco Bay	Approximately 45 feet upstream of Veterans Boulevard	Regional Regression Analysis	USACE HEC-2	*	AE	A U.S. Geological Survey stream-gaging station (No. 11-1628.00), located on the upper reach of Redwood Creek west of the corporate limits, has operated since 1960 (Reference 13). A frequency analysis was made of the flood peak record. The gage is one of the two San Mateo County gages used in developing the original regression equations. However, the results were not directly applied to the study reach on lower Redwood Creek due to the vastly different character of the highly urbanized intervening drainage and the resulting modification to the hydrologic response. Therefore, the regional relationships developed at this and other gaging stations were transferred t o the lower reaches of Redwood Creek and the ungaged basins in Redwood City by means of the statistically derived regression equations. The significant basin characteristics relating to flood peaks were drainage area and mean annual precipitation (Reference 16).

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Redwood Creek, continued	Confluence with San Francisco Bay	Approximately 45 feet upstream of Veterans Boulevard	Regional Regression Analysis	USACE HEC-2	*	AE	Starting water-surface elevations were calculated using the Mean Higher High Water elevation of 4.0 feet for the tides in San Francisco Bay.
Redwood Creek	Approximately 200 feet downstream of Main Street	Approximately 450 feet upstream of Lathrop Street	Regional Regression Analysis	USACE HEC-2	*	A	*
Rockaway Creek	Confluence with Pacific Ocean	Approximately 180 feet upstream of confluence with Pacific Ocean	Regional Regression Analysis	USACE HEC-2	*	VE, AE	*
Rockaway Creek	Approximately 200 feet downstream of Old Country Road	Approximately 990 feet upstream of Troglia Terrace	Regional Regression Analysis	USACE HEC-2	*	A	*
San Francisquito Creek	Confluence with San Francisco Bay	At San Mateo Drive	Log Pearson Type III Frequency Analysis, Combining and Routing Hydrographs, and USACE HEC-2	USACE HEC-2	*	AE, A	A stream-gaging station (U.S. Geological Survey No. 11-1645) is located on San Francisquito Creek (1930-1941, 1951-1978) approximately 2 miles upstream of El Camino Real. Log-Pearson type III frequency analyses (Reference 14) were performed on the gage flood-peak records. Potential frequency-discharge rates downstream of the USGS stream gage 11-1645 on San Francisquito Creek were determined by combining and routing hydrographs from the intervening urban subbasins. The restudied overflow discharges were calculated using split-flow routines in the USACE HEC-2 computer program (Reference 19).

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
San Francisquito Creek, continued	Confluence with San Francisco Bay	Approximately 1 mile upstream from confluence with San Francisco Bay	Log Pearson Type III Frequency Analysis, Combining and Routing Hydrographs, and USACE HEC-2	USACE HEC-2	*	AE	Water-surface elevations for San Francisquito Creek were computed by George S. Nolte & Associates (Reference 17) using the USACE HEC-2 step-backwater computer program (Reference 19), supplemented by hand calculations where required. Starting water-surface elevation was set at the Mean Higher High Water tidal level in San Francisco Bay. The restudied overflow discharges from San Francisquito Creek were calculated using split-flow routines in the USACE HEC-2 computer program (Reference 19). The revised detailed hydraulic analysis for San Francisquito Creek and the overflow areas used the USACE HEC-2 computer program. Starting water-surface elevations were determined using the slope-area (normal-depth) method.
San Francisquito Creek	Approximately 1 mile upstream from confluence with San Francisco Bay	At San Mateo Drive	Log Pearson Type III Frequency Analysis, Combining and Routing Hydrographs, and USACE HEC-2	USACE HEC-2	*	A	*
San Gregorio Creek	Approximately 119 feet downstream of Dirt Road	Approximately 0.6 mile upstream of confluence with La Honda Creek	Regional Regression Analysis	USACE HEC-2	*	AE	*
San Gregorio Creek	At mouth	Approximately 1,374 feet upstream of confluence of Harrington Creek	Regional Regression Analysis	USACE HEC-2	*	A	*

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
San Mateo Creek	Confluence with San Francisco Bay	Approximately 555 feet upstream of El Cerrito Avenue	USACE HEC-1	USACE HEC-2 and HEC-RAS	*	AE	Rainfall data used in the analysis were taken from the U.S. Geological Survey (USGS) open-file report entitled “Mean Annual Precipitation Depth-Duration-Frequency Data for the San Francisco Bay Region, California” (Reference 23). Due to the reservoir storage in the San Mateo Creek watershed, a long-duration storm is required to compute peak flows. 10-day storm duration was selected for this study to allow for the computation of the entire flow hydrograph. NRCS curve-number (CN) methodology was used to compute infiltration losses. The ground cover for the area below Lower Crystal Springs Dam was estimated using NRCS procedures for urbanized areas. The Muskingum-Cunge routing option of HEC-1 was used for channels where detailed topographic information is not available. All culverts and bridges were analyzed using the USACE HEC-2 computer program, except the long culvert under Mills Hospital, located in the City of San Mateo that extends from approximately 6,740 feet to approximately 8,585 feet above the mouth of San Mateo Creek, which was analyzed manually. The rating curve developed for this culvert was then included in the HEC-2 analyses. The long culvert consists of a mixture of different underground structures, including box and arch culverts and covered channels with vertical walls. Survey cross sections, culverts, and bridge dimensions were taken from available data and supplemented by field measurements where necessary.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
San Mateo Creek, continued	Confluence with San Francisco Bay	Approximately 555 feet upstream of El Cerrito Avenue	USACE HEC-1	USACE HEC-2 and HEC-RAS	*	AE	Water-surface elevations for San Mateo Creek upstream of East 3rd Avenue were computed using the USACE HEC-2 computer program (Reference 43), water- surface elevations downstream of East 3rd Avenue were computed using the USACE HEC-RAS computer program. The starting water-surface elevation is the mean higher high water-surface elevation for the San Francisco Bay at the mouth of San Mateo Creek.
San Pedro Creek	Confluence with Pacific Ocean	Approximately 700 feet upstream of Linda Mar Boulevard	Regional Regression Analysis	USACE HEC-2	*	A	*
San Vicente Creek	Approximately 160 feet downstream of Parking Lot	Approximately 1.1 miles upstream of Etheldore Street	Regional Regression Analysis	USACE HEC-2	*	AE	*
San Vicente Creek	Approximately 1.1 miles upstream of Etheldore Street	Approximately 1.7 miles upstream of Etheldore Street	Regional Regression Analysis	USACE HEC-2	*	A	*
Sanchez Creek	At Mission Street	Approximately 546 feet upstream of Drake Avenue	Regional Regression Analysis	Direct Step-Backwater Computer Program	*	A	*
Sausal Creek	At Family Farm Road	Approximately 55 feet upstream of the confluence with Bull Run Creek	NRCS Design Hydrograph Method	Rainfall-Runoff, Topographic Features, and Normal Depth Calculations	*	AE	The portion of Corte Madera Creek upstream from Alpine Road and the unnamed tributary to Corte Madera Creek were not studied in detail because of the lack of current or planned development along those streams. The 1-percent annual chance flood for those streams was approximated based on regional rainfall-runoff estimates, topographic features, and normal depth calculations.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Searsville Lake	Approximately 1,550 feet upstream of confluence of Bear Gulch Creek	Approximately 3,300 feet upstream of confluence of Bear Gulch Creek	Regional Regression Analysis	USACE HEC-2	*	A	*
Sharp Park Creek	At mouth	Approximately 1,486 feet upstream of Lundy Way	Regional Regression Analysis	USACE HEC-2	*	A	*
Tahana Gulch	Confluence with Bradley Creek	Approximately 1,400 feet upstream of confluence with Bradley Creek	Regional Regression Analysis	USACE HEC-2	*	A	*
Tunitas Creek	Confluence with Pacific Ocean	Approximately 208 feet upstream of confluence of Dry Creek	Regional Regression Analysis	USACE HEC-2	*	VE, A	*
West Union Creek	Confluence with Bear Gulch Creek	Confluence with Tripp Gulch	Flood-Frequency Analysis	U.S. Geological Survey computer Program A526	*	AE	*
Woodhams Creek	Confluence with La Honda Creek	Approximately 8 feet upstream of Esmeralda Terrace	Regional Regression Analysis	USACE HEC-2	*	AE	*
Yankee Jim Gulch	Confluence with Pacific Ocean	Approximately 1,739 feet upstream of confluence with Pacific Ocean	Regional Regression Analysis	USACE HEC-2	*	VE, A	*

Table 14: Roughness Coefficients

Flooding Source	Channel “n”	Overbank “n”
City of Burlingame	0.019-0.050	0.020-0.080
City of East Palo Alto	0.015-0.080	0.12-0.14
Town of Hillsborough	0.035-0.055	0.020-0.100
City of Menlo Park	0.015-0.080	0.12-0.14
City of Millbrae	0.019-0.050	0.020-0.080
City of Pacifica	0.027-0.110	0.020-0.100
City of Redwood City	0.014-0.050	0.020-0.100
City of South San Francisco	0.015-0.035	0.040-0.100
San Mateo County, Unincorporated Areas	0.019-0.050	0.020-0.100

5.3 Coastal Analyses

For the areas of San Mateo County that are impacted by coastal flooding processes, coastal flood hazard analyses were performed to provide estimates of coastal BFEs. Coastal BFEs reflect the increase in water levels during a flood event due to extreme tides and storm surge as well as overland wave effects.

The following subsections provide summaries of how each coastal process was considered for this FIS Report. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation. Table 15 summarizes the methods and/or models used for the coastal analyses. Refer to Section 2.5.1 for descriptions of the terms used in this section.

Table 15: Summary of Coastal Analyses

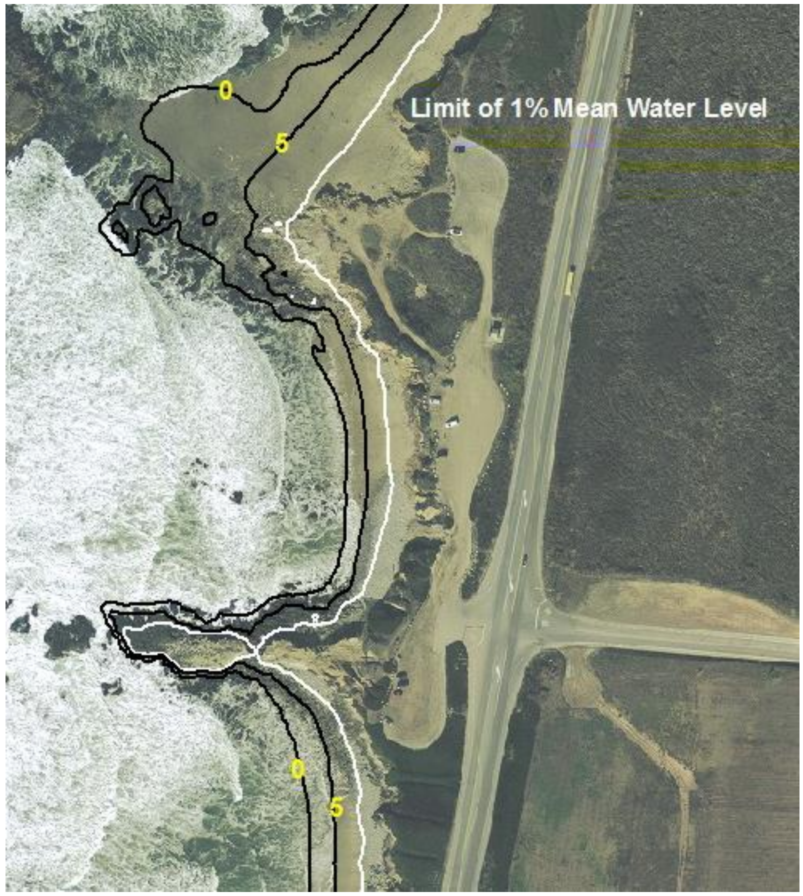
Flooding Source	Study Limits From	Study Limits To	Hazard Evaluated	Model or Method Used	Date Analysis was Completed
San Francisco Bay	San Mateo Bridge (Hwy 92)	San Mateo-Santa Clara County boundary	Storm Surge	MIKE 21 HD/NHD	5/25/2011
San Francisco Bay	San Mateo Bridge (Hwy 92)	San Mateo-Santa Clara County boundary	Runup	Other	5/7/2014
San Francisco Bay	San Mateo Bridge (Hwy 92)	San Mateo-Santa Clara County boundary	Wave Setup	Direct Integration Method (DIM)	5/7/2014

Flooding Source	Study Limits From	Study Limits To	Hazard Evaluated	Model or Method Used	Date Analysis was Completed
San Francisco Bay	San Francisco-San Mateo County border	South along San Francisco Bay to the San Mateo Bridge (RT 92)	Storm Surge	MIKE 21 HD/NHD	5/25/2011
San Francisco Bay	San Francisco-San Mateo County border	South along San Francisco Bay to the San Mateo Bridge (RT 92)	Runup	Other	5/7/2014
San Francisco Bay	San Francisco-San Mateo County border	South along San Francisco Bay to the San Mateo Bridge (RT 92)	Wave Setup	Direct Integration Method (DIM)	8/22/2013
Pacific Ocean	Southern San Francisco border	North Santa Cruz County border	Wave Runup	FEMA Pacific Guidelines (2005). Stockdon, DIM, and TAW	1/14/2015

5.3.1 Total Stillwater Elevations

The total stillwater elevations (stillwater including storm surge plus wave setup) for the 1% annual chance flood were determined for areas subject to coastal flooding. The models and methods that were used to determine storm surge and wave setup are listed in Table 15. Tide station data used as input for the stillwater levels serves two purposes. First, the tide data is the basis for an hourly stillwater level (SWL) 50-year hindcast time series from 1960-2009 needed for coastal analysis necessary to determine open coast BFEs. Secondly, the recorded annual maxima from the long-term tide stations are used to statistically determine the 1-percent chance stillwater level elevations (SWEL), which are also required for analysis and mapping purposes. The stations used to compute the stillwater levels vary based on alongshore location and are listed in Table 17 along with the statistical method used to compute the SWEL. Figure 8 shows the stillwater elevations for the 1% annual chance flood that was determined for this coastal analysis.

Figure 8: 1% Annual Chance Total Stillwater Elevations for Coastal Areas



Astronomical Tide

Astronomical tidal statistics were generated directly from local tidal constituents by sampling the predicted tide at random times throughout the tidal epoch.

Storm Surge Statistics

Storm surge is modeled based on characteristics of actual storms responsible for significant coastal flooding. The characteristics of these storms are typically determined by statistical study of the regional historical record of storms of by statistical study of tidal gages.

When historic records are used to calculate storm surge, characteristics such as the strength, size, track, etc., of storms are identified by site.

Tidal gages can be used instead of historic records of storms when the available tidal gage record for the area represents both the astronomical tide component and the storm surge component. Table 16 provides the gage name, managing agency, gage type, gage identifier, start date, end date, and statistical methodology applied to each gage used to determine the stillwater elevations. For areas between gages, peak stillwater elevations for selected recurrence intervals were estimated by combining interpolation between gages and observed high water marks during major storms. A regionalized statistical approach was applied to the gage data so that stillwater elevations in areas between gages could be identified.

Table 16: Tide Gage Analysis Specifics

Gage Name	Managing Agency of Tide Gage Record	Gage Type	Start Date	End Date	Statistical Methodology
Arena Cove	NOAA	Tide	4/10/1933	12/31/2009	*
San Francisco (9414290)	NOAA	Tide	06/30/1854	Present	GEV
Ocean Beach (9414275)[1]	NOAA	Tide	*	*	*
Princeton, Half Moon Bay (9414129)[1]	NOAA	Tide	*	*	*
Ano Nuevo Island (9413878)[1]	NOAA	Tide	*	*	*
Monterey	NOAA	Tide	11/4/1973	12/31/2009	GEV

*Data Not Available

[1]Indicates a subordinate tide station.

Combined Riverine and Tidal Effects

Not applicable to this Flood Risk Project

Wave Setup Analysis

Wave setup was computed during the storm modeling through the methods and models listed in Table 15 and included in the frequency analysis for the determination of the total Stillwater elevations.

5.3.2 Waves

An integral component of the transect-based TWL analysis is an accurate determination of the offshore and nearshore wave climate. A continuous 50-year hourly deep-water wave hindcast was developed by Oceanweather Inc using reanalysis of historical wind fields. Three nested model grid components of sequentially higher resolution were used to resolve wave conditions of varying spatial scales, including basin (global), regional (Northeast Pacific Ocean), and coastal (California) grids.

The deep-water dataset was further transformed to reflect nearshore conditions at the edge of the surf zone in approximately 33-49 feet water depth. The nearshore wave transformation component was carried out by the Scripps Institute of Oceanography (SIO) Coastal Data Information Program (CDIP) research group in collaboration with BakerAECOM using the SIO SHELF model. The output from this wave transformation model provides the input conditions for the 1-D transect-based coastal hazard analysis used to calculate BFEs.

5.3.3 Coastal Erosion

A single storm episode can cause extensive erosion in coastal areas. Storm-induced erosion was evaluated to determine the modification to existing topography that is expected to be associated with flooding events. Erosion was evaluated using the methods listed in Table 15. The post-event eroded profile was used for the subsequent transect-based onshore wave hazard analyses.